LEVEL III

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PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS

ON

LORAIN HARBOR OHIO

AD A109462

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VOLUME 2

APPENDICES

U.S. ARMY ENGINEER DISTRICT, BUFFALO
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Black River
Commercial Navigation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The objectives of this Stage 2 study are: (1) To evaluate a full range of alternatives for commercial navigation modifications at Lorain Harbor considering benefits, costs, social and environmental implications, and constraints that might be imposed on improvements in the interest of recreational navigation and sedimentation. (2) To recommend those commercial navigation alternatives which warrant additional study during the detailed study phase (Stage 3).

The conclusion of this report is that the most feasible alternatives for fulfilling the commercial navigation planning objective is delivery of iron ore to a trans-shipment facility located either on the lakefront at the Old Coal Dock, or preferably on the west bank of the Black River just south of the Erie Avenue Bridge. Delivery of pellets to the trans-shipment facility would be by either delivery to an off-load hopper at the lakefront and conveyor system for delivery to the trans-shipment facility. Upriver pellet movement would be accomplished by either a conveyor located on the west bank of the Black River or a special purpose vessel operating on the river with its existing configuration.

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PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS
ON
LORAIN HARBOR
OHIO

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PRELIMINARY ENGINEERING DESIGN
AND
COST ESTIMATES

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APPENDIX A

PRELIMINARY ENGINEERING DESIGNS
AND
COST ESTIMATES

FOR MODIFICATIONS TO

LORAIN HARBOR, OHIO

CORPS OF ENGINEERS, U.S. ARMY
BUFFALO DISTRICT

NOVEMBER 1979

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SECTION 1 - INTRODUCTION

PURPOSE

This technical appendix documents work performed in the preparation of preliminary engineering designs, cost estimates and other related work for modifications to the Federal commercial navigation project at Lorain Harbor, Ohio. The documented work is part of a "Preliminary Feasibility Report" for commercial navigation improvements to Lorain Harbor being prepared by the Buffalo District, U.S. Army Corps of Engineers. The purpose of this report therefore is to clearly document the engineering analysis, quantity estimates and cost estimates developed for proposed alternative navigation improvements. Prime emphasis has been on alternative engineering solutions that would enable passage and safe navigation of new and larger vessels operating on the Great Lakes. It has been determined that the solutions should meet the navigation needs of vessels in the Class 10 (1,000 feet x 105 feet x 28 feet) and larger categories (1,200 feet x 130 feet x 28 feet) that are now, or are projected to operate on the Great Lakes.

In addition, this report documents the study and analysis of the physical requirements and the impacts of a small boat harbor in the Inner Harbor area.

REPORTING FORMAT

This technical appendix is divided into a total of seven sections. In addition to this Introduction, there are five preliminary sections which document background details on each of the major areas of potential harbor improvements. Section 2 provides background on potential improvements to the Outer Harbor area. Section 3 lists details on potential

channel improvements. Possible bridge improvements are detailed in Section 4. Section 5 documents engineering design and cost estimates for a tunnel to replace the existing Erie Avenue Bridge. Potential construction of a transshipment facility with upriver transfer is detailed and costed in Section 6. Each of these major construction items can be combined in numerous ways to form alternatives. The combinations developed for Lorain Harbor are presented in Section 7.

The cost estimates presented in Sections 2 to 6 show direct construction costs and land cost estimates. Contractor overhead and profit, contingencies, engineering, design, supervision, and administration are added in the final section which provides total costs for the 16 potential alternatives developed.

SCOPE

Design and cost estimates developed are based on existing information; no new field studies were performed. The information utilized was provided by the Corps of Engineers, or gathered from personal interviews or telephone conservations with local officials, local industries or vessel masters. Pertinent correspondence is provided as Attachment 3.

Original preliminary designs and cost estimates were to be developed for the ten commercial navigation alternatives listed in Section X of the Lorain Harbor Reconnaissance Report. Ultimately the list of alternatives was expanded to sixteen. The additional alternatives resulted from the identification of new construction items that were found to be feasible alternatives to those recommended in the Reconnaissance Report. In particular, these included a new movable bridge at Erie Avenue, upriver transshipment via a

special purpose vessel in lieu of a barge, upriver transshipment via existing rail lines and upriver transshipment via a private truck road system.

The detailing of cost estimates into features and subfeatures are as complete as possible and include quantities and unit costs for all main construction items. All costs are at the February 1979 price level. In addition to quantity and cost estimates, written descriptions of each work item are provided, and include, where appropriate, drawings.

Estimates of quantities and costs for the smallboat harbor have not been prepared under this work order. This work has included preliminary design and layout of a 400 to 500 slip marina, including location of launching ramps, access roads and sanitary facilities. This work has been oriented toward making an assessment of potential conflicts between commercial navigation alternatives and the future marina.

The scope of work also includes the assemblage of appropriate construction items into the 16 navigation improvement alternatives. For each, a written description of the construction items included in the alternatives and the overall effects of the alternative are given.

DEFINITION OF TERMS

A number of terms are used throughout this report which should be defined in order to assure that the reader fully understands the discussions.

Concepts. This term is used to describe in somewhat general terms the various approaches that could be taken to improve Lorain Harbor. Namely these are: (1) improve the

harbor for navigation over the complete length of the currently authorized Federal Project Area, which is to the Upper Turning Basin, (2) improve the harbor for navigation to the Lower Turning Basin below the 21st Street Bridge, and (3) improve the harbor for navigation in the Lakefront area only.

Options. The engineering designs and cost estimates provided in this report are for two navigation options: (1) a maximum navigable ship size of 1,000 feet and (2) a maximum navigable ship size of 1,200 feet.

Construction Items. This term is used to describe the major items that must be constructed or rehabilitated in order to fulfill the concept and option requirement. The 17 various construction items are listed later in this section.

Alternatives. The various construction items have been assembled in various ways in order to develop solutions to the various harbor improvement concepts. These alternatives (16 in all) also have been developed to fulfill requirements of the two ship size options.

OVERVIEW OF CONSTRUCTION ITEMS

In all, 17 various construction items have been considered in the analysis of improvements to Lorain Harbor. Each of these construction items are shown on Plate 1-1. These items are:

A. Enlarge or reorient Outer Harbor entrance.
B. Construct new channel through Riverside Park.
C. Replace Erie Avenue Bridge with a high level structure.

D. Replace Erie Avenue Bridge with a movable bridge.

E. Replace Erie Avenue Bridge with a tunnel under the river.

F. Enlarge channel.

G. Enlarge Lower Turning Basin.

H. Enlarge Upper Turning Basin.

I. Replace 21st Street Bridge with higher structure.

J. Construct conveyor transfer facility below 21st Street.

K. Construct conveyor system upriver from 21st Street.

L. Construct transshipment facility at Lakefront.

M. Construct upriver conveyor system.

N. Construct upriver special purpose vessel facility.

O. Construct upriver rail facility.

P. Construct upriver truck system.

Q. Modify N&W railroad bridge.

Items A to P were considered for the 1,000-foot vessel option while these plus Item Q were found to be required when considering the 1,200-foot vessel option. Q, Modification of the N&W railroad bridge, was found to be necessary after discovering that the bridge will not raise to the required height for the 1,200-foot vessel. The current clearance of this structure is 123'-8" above Low Water Datum. Estimates of clearance requirements above water for future 1,200 foot vessels was found from shipbuilders to be from 123 to 125 feet. Accordingly, estimates were undertaken to renovate this lift bridge to be capable of raising to 135 feet. This would insure adequate clearance for all future ship sizes.

These construction items can be classified as necessary under three basic harbor improvement concepts: (1) improve the harbor for navigation over the complete length of the currently authorized Federal Project area, which is to the Upper Turning Basin, (2) improve the harbor for navigation

to the Lower Turning Basin below the 21st Street Bridge, and (3) improve the harbor for navigation in the Lakefront area only. Construction items A to I and Q (for the 1,200-foot option) are necessary for Concept (1). Construction items A, B, J, K and Q are necessary under Concept (2). Construction items A, B and L to P are necessary for Concept (3).

Each of the construction items are addressed in detail in one of the following five sections. Section 2 addresses Item A, Outer Harbor improvements, as well as the small-boat harbor requirements. Section 3 considers the channelization improvements, Items B, F, G and H. Section 4 addresses bridge construction or modifications, Items C, D, I and Q. Section 5 covers Item E, tunnels. Transshipment items J, K, L, M, N, O and P are addressed in Section 6.

The last section of the report addresses the 16 potential overall improvement alternatives available from the above construction items.

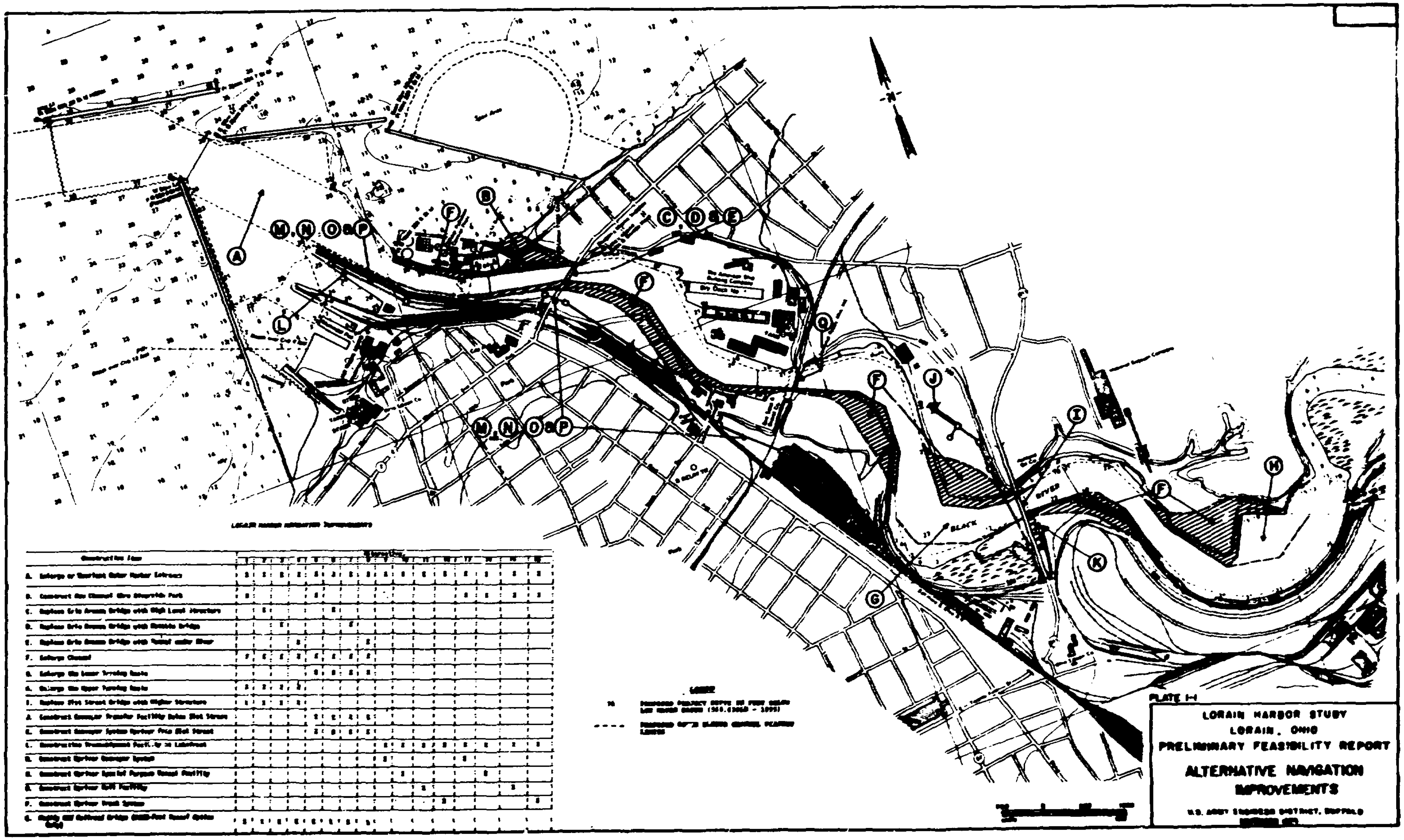


PLATE I-I
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE NAVIGATION
IMPROVEMENTS
U.S. ARMY ENGINEER DISTRICT, BUFFALO

SECTION 2 - OUTER HARBOR

GENERAL

Scope. The scope of work included preliminary feasibility investigations associated with the Outer Harbor of Lorain (See Plate 2-1). This included evaluation of the need for modifications or alterations to the detached breakwater and the entrance to the Outer Harbor to enable 1,000-foot vessels and 1,200-foot vessels to efficiently enter and navigate the Outer and Inner Harbor for all of the commercial navigation alternatives. Possible modification plans, quantity and cost estimates were to be developed.

In addition to evaluation of Harbor modifications, the work included a preliminary design of a small-boat harbor along the East Shorearm Breakwater of the Inner Harbor. The scope was to include marina layouts in this area for a 400 to 500 slip facility, parking on the dike disposal site, launching ramps, access roads and sanitary facilities. Quantity and cost estimates for the small-boat harbor and marina were not a part of the scope of work.

Criteria. Analysis and design of Outer Harbor navigation improvements have been based on 1) discussions with vessel masters familiar with Lorain Harbor, 2) recent experiences from the Cleveland Harbor Final Feasibility Study, 3) Corps of Engineers engineering manuals, 4) input from the Coastal Engineering Section of the Buffalo District, and 5) scale-model tests of vessel maneuvers in the Outer Harbor using 1" = 500' cardboard ship models.

Criteria for the preliminary feasibility analysis include harbor depth, vessel turning capabilities and

harbor protection. Depth requirements must include consideration of the vessel static draft, squat, roll, pitch and clearance. Development of these requirements are based on EM 1110-2-1607, Channel and Harbor Design, depth requirement computations in the Cleveland Harbor Feasibility Report, and the Maximum Ship Size Study by the North Central Division of the Corps of Engineers. Vessel maneuvering and turning requirements are based primarily on vessel master comments. Harbor protection requirements (breakwater modifications) are based on input from the Coastal Engineering Section of the Buffalo District.

Design of the small boat harbor has been based on criteria outlined in a 1969 Report on Small Craft Harbors by the American Society of Civil Engineers. Craft type in Lorain has been derived from a 1970 report by Stanley Consultants entitled "Recreational Boating and Commercial Docking Facilities, Lorain, OH." Design requirements for a protective marina breakwater are based on the Shore Protection Manual Volume II by the U.S. Army Coastal Engineering Research Center.

EVALUATION

Breakwater Modifications. To accommodate both 1,000-foot and 1,200-foot vessels the harbor entrance must be widened. Discussions with vessel masters indicate that the current opening between the West Breakwater and the East Breakwater is restrictive for the larger vessels. It was learned from vessel masters that harbor entrance currents and winds are such that a vessel entering the harbor will naturally drift and turn toward the Black River Channel entrance. Caution must be taken that the drifting, turning action does not drive the vessel into the West Breakwater Lighthouse. Two alternative modifications were considered

that would alleviate this problem: 1) swing 500 feet of the West Breakwater out, to the west; or 2) remove 600 feet of the western end of the East Breakwater and lengthen the eastern end of the Outer Breakwater by 600 feet. Either alternative would have the same effect: widen the channel entrance from 550 to 900 feet at its most narrow point.

The need to relocate a portion of the West Breakwater was also considered for alternatives that include lakefront transshipment facilities in the area of the coal docks and federal pier. It was originally perceived that swinging a portion of the West Breakwater would not only be required to enlarge the Outer Harbor Channel entrance (as listed as alternative 1 above) but to also enable maneuvering into the transshipment area. It was determined by using scale model 1,000- and 1,200-foot vessels however that both should be able to maneuver into the existing harbor berthing area without modifications to this breakwater. Detailed scale modeling of the ship maneuvering problems into a transshipment facility may be necessary to verify these preliminary findings.

The second alternative was selected as the preferred alternative for a number of reasons. Swinging a portion of the West Breakwater out would leave more of the Inner Harbor unprotected from the open Lake. Moving the West Breakwater would also require relocation or demolition of the West Breakwater Lighthouse, a structure listed as a National Historic Landmark. Modifications to the East and Outer Breakwaters could provide the same entrance width without any of the anticipated negative effects.

East Breakwater removal (See Plate 2-1) estimates are based on methods defined in the <u>Shore Protection Manual</u>, Chapter 7. Estimates for relocation of the East Breakwater

Light are also provided as a separate cost. Quantity estimates for the Outer Breakwater addition are listed in the cost estimate section. These estimates were developed by the Consultant with use of recent construction bids for similar breakwater construction as a guide.

The weight of stone estimated to be removed is as follows:

Primary Armor Stone:	32,000 tons
First Underlayer :	14,000 tons
Core :	32,000 tons
Total	78,000 tons

The 600 foot lengthening of the Outer Breakwater would be similar construction as the existing Outer Breakwater section, namely steel sheet pile cells. Plate 2-2 shows a typical section of this breakwater.

Dredging Requirements for Initial Construction. Dredging requirements for initial construction for the harbor area are based on channel depth requirements for a 25.5-foot static draft 1,000- or 1,200-foot vessel entering Lorain Harbor at Low Water Datum water level. Depth requirements are based on the prediction by vessel masters that they would enter the harbor with vessels of these lengths and drafts only in non-storm conditions. Non-storm conditions are defined as weather with winds under 25 miles-per-hour. Depth requirements are subdivided into Lake Approach Channel, Harbor Channel and River Approach due to the varying wave action and vessel speeds in the three areas. Areas of required construction dredging for the existing channel approach, upriver navigation with a Riverside Park Cut and transshipment with a Riverside Park Cut are shown on Plates

2-3, 2-4 and 2-5 respectively. Depth requirements were determined using the following criteria: design vessel static draft (25.5 feet), squat, roll, pitch and bottom clearance (2 feet for soft bottoms as in Lorain). Vessel squat was estimated using the following formula:

$$S = \frac{V_1^2}{2g}\left[\left(1.01\,\frac{A_1}{A_W}\right)^2 - 0.84\right]$$

where S = squat @ speed V_1 (ft.)
V_1 = vessel velocity (ft./sec.) relative to water
A_1 = channel cross sectional area (sq.ft.)
A_W = channel cross sectional area less vessel cross sectional area (sq.ft.)
g = 32.2 ft./sec.^{2}

The estimate assumptions are shown in Table 2.1.

TABLE 2.1 DEPTH CRITERIA ASSUMPTIONS

	V_1 (ft./sec.)	A_1 (sq. ft.)	A_W (sq. ft.)
Lake Approach Channel	17.6 (12 mph)	900 x 31	A_1 - (beam x 25.5)
Harbor Channel	13.2 (9 mph)	900 x 29	A_1 - (beam x 25.5)
River Approach	5.9 (4 mph)	300 x 28	A_1 - (beam x 25.5)

Pitch and roll experienced are a function of the position of a vessel to wave crests. Pitch occurs when waves are normal to the hull while roll occurs with wave parallel to the hull. 100 percent roll and zero pitch was assumed to be a controlling criteria as opposed to a combination of roll and pitch or 100 percent pitch. Depth due to roll can be estimated as follows:

$$Y = \frac{B}{2}\sin\theta$$

where Y = depth requirement due to roll (ft.)
B = design vessel beam (ft.)
θ = roll in degrees

It was assumed that a maximum 3° of roll is experienced in the Lake Approach Channel and 0° in the Harbor Channel

and River Approach. In addition it can be assumed that the effects of these phenomenon for 1,200-foot vessels will result in nearly identical depth requirements. In the Lake Approach Channel, 1200-footers will probably be more stable due to a wider beam and therefore experience less roll (approximately 1°-2°). It is expected that vessel speeds will also be slightly reduced on 1,200-foot vessels. These criteria are based on work performed by North Central Division of the Corps of Engineers in the Maximum Ship Size Study.

TABLE 2.2 SUMMARY OF DEPTH CALCULATIONS

Lake Approach Channel:		
design vessel static draft	-	25.5 feet
squat @ 12 mph		
3° roll	-	3.7 feet
pitch		
bottom clearance	-	2.0 feet
Total	-	31.2 feet
	Say	31.0 feet
Harbor Channel:		
design vessel static draft	-	25.5 feet
squat @ 9 mph		
0° roll	-	1.1 feet
pitch		
bottom clearance	-	2.0 feet
Total	-	28.6 feet
	Say	29.0 feet
River Approach:		
design vessel static draft	-	25.5 feet
squat @ 4 mph		
0° roll	-	0.7 feet
pitch		
bottom clearance	-	2.0 feet
Total	-	28.2 feet
	Say	28.0 feet

Outer Harbor dredging requirements can be summarized as follows:

Existing River Channel Entrance-Navigation to Upper or Lower Turning Basin W/O Riverside Park Cut (Plate 2-3)

1,000-Foot Option	1,200-Foot Option
[illegible]4,800 Cubic Yards	214,800 Cubic Yards

Relocated River Channel Entrance Through Riverside Park-Navigation to Upper or Lower Turning Basin (Plate 2-4)

1,000-Foot Option	1,200-Foot Option
222,200 Cubic Yards	222,400 Cubic Yards

Relocated River Channel Entrance Through Riverside Park with Lakefront Transshipment-Lakefront Navigation only to Amship (Plate 2-5)

1,000-Foot Option	1,200-Foot Option
225,300 Cubic Yards	225,500 Cubic Yards

As shown, additional dredging requirements to accommodate 1,200-foot vessels is negligible. This is largely due to the fact that both vessels have identical static drafts and only differ in beam width by 25 feet.

Marina Requirements. Design requirements are based on a minimum 400 craft marina. Using the craft distribution developed in the 1970 Stanley Consultants' report, the distribution for a total capacity of 408 craft marina was developed. The results of this distribution is shown in Table 2.3.

TABLE 2.3 CRAFT DISTRIBUTION

		Required Dimensions (feet)		
Type of Craft	Number	Berth Length	Pier Finger Width	Center-to-Center Distance Between Adjacent Piers
Class A - under 16'	148	20	20	83
Class 1 - 16'-25'	128	30	28	121
Class 2 - 26'-39'	92	40	32	158
Class 3 - 40'-65'	40	60	42	248
Fuel Docking	4	60	42	--
Ramp Launches	2	40	32	--
Hoist Launches	1	40	32	--

Using these basis for a marina layout it was estimated that 16 acres of harbor area along the East Shorearm Breakwater will be required to accommodate the requirement listed above. It was found that with the Riverside Park cut, approximately 23 acres of harbor area are available for marina usage. Therefore it is concluded that a 400-500 boat marina can be accommodated with a relocated river channel entrance. It should be noted that without relocating the river entrance, the full 952 boat marina recommended by Stanley Consultants can be accommodated adjacent to the East Shorearm Breakwater and Dike Disposal Area.

With the optional channel cut through Riverside Park, the marina would require protection from both the Lake and commercial vessel traffic. For environmental reasons it was determined that protection by a rubblemound breakwater would be advantageous. The quantity of stone required for the marina breakwater has been developed based on methods listed in the Shore Protection Manual, Chapter 7. Using the Manual's criteria the following quantities of stone are estimated as required for the marina location:

Stone Size	Quantity	Unit
Maximum 3.5 tons	31,860	tons
Maximum 1.75 tons	2,683	tons
Maximum 700 lbs.	7,283	tons
Maximum 150 lbs.	46,440	tons

Quantity estimates are based on a 1,500-foot rubbermound breakwater to protect the anticipated marina layout. A typical section of the breakwater is shown in Plate 2-6. This marina breakwater or a modified version will be required for the small boat harbor to reduce minor harbor waves to approximately 1-foot irrespective of the commercial navigation concept which is eventually developed. Therefore actual marina breakwater construction will be cost shared as a

commercial and recreational navigation expense. However, as a conservative approach to this preliminary analysis, total costs for this subject breakwater have been allocated as a commercial navigation expense.

COST ESTIMATES

Cost estimates for four harbor related construction items have been considered. They are 1) East Breakwater removal, 2) Outer Breakwater construction, 3) Dredging, and 4) Marina Breakwater construction. Construction dredging costs are based on removal of polluted material with land based disposal.

Cost differences between the 1,000-foot option and 1,200-foot option is in dredging, which amounts to a difference of 200 cubic yards. For purposes of this preliminary estimate, it is assumed that harbor-related costs for either option are the same. Costs shown include the total costs of the marina breakwater as an allocated commercial navigation expense as previously discussed. Costs for engineering, design, construction supervision and administration are not included in these direct cost estimates. These are included in the alternatives cost estimate provided in Section 7.

TABLE 2.4 OUTER HARBOR COSTS FOR NAVIGATION IMPROVEMENTS W/O RIVERSIDE PARK CUT

Item	Quantity	Unit	Unit Price	Cost
East Breakwater Removal	78,000	Ton	$ 17.00	$1,326,000
Relocation East Breakwater Light	--	L.S.	--	50,000
Outer Breakwater Construction (46-foot diameter sheetpile cells, see Plate 2-2)				
Type PS-28 Sheet Pile	73,000	L.F.	13.50	985,500
Fabricated T-Sections Sheet Pile	2,500	L.F.	13.50	108,750
Concrete Cap	1,400	C.Y.	96.00	134,400
Welded Wire	2,100	S.Y.	3.50	7,350
Cell Fill*	18,000	Ton	--	--
Stone Protection*	22,000	Ton	--	--
				$1,236,000
Total Breakwater Costs				$2,612,000
			Say	$2.6 million
Total Construction Dredging (of polluted material)	214,800	C.Y.	13.00	$2,792,400
			Say	$2.8 million
			Total Direct Costs	$5,404,400
			Say	$5.4 million

TABLE 2.5 OUTER HARBOR COSTS FOR NAVIGATION IMPROVEMENTS TO UPPER OR LOWER TURNING BASIN W/RIVERSIDE PARK CUT

Item	Quantity	Unit	Unit Price	Cost
East Breakwater Removal	78,000	Ton	$ 17.00	$1,326,000
Relocation East Breakwater Light	--	L.S.	--	50,000

Outer Breakwater Construction (see detailed list above)	--	L.S.	--	1,236,000
Marina Breakwater Construction (1500-foot rubblemound, see Plate 2-6)				
Stone Size:				
Max. 3.5 tons	31,860	Ton	36.50	1,162,890
Max. 1.75 tons	2,683	Ton	35.50	95,246
Max. 700#	7,283	Ton	10.00	72,830
Max. 150#*	46,440	Ton	--	--
				$1,330,966
Total Breakwater Costs				$3,942,966
			Say	$3.9 million
Total Dredging	222,200	C.Y.	13.00	$2,888,600
			Say	$2.9 million
			Total Direct Costs	$6,831,566
			Say	$6.8 million

TABLE 2.6 OUTER HARBOR COSTS FOR NAVIGATION IMPROVEMENTS FOR LAKEFRONT TRANSSHIPMENT W/RIVERSIDE PARK CUT

Item	Quantity	Unit	Unit Price	Cost
East Breakwater Removal	78,000	Ton	$ 17.00	$1,326,000
Relocation East Breakwater Light	--	L.S.	--	50,000
Outer Breakwater Construction (see detailed list above)	--	L.S.	--	1,236,000
Marina Breakwater Construction (see detailed list above)	--	L.S.	--	1,330,966
Total Breakwater Costs				$3,942,966
			Say	$3.9 million

Total Dredging	225,300	C.Y.	13.00	$2,928,900
			Say	$2.9 million
		Total Direct Costs		$7,097,966
			Say	$7.1 million

* Material reused from East Breakwater removal. It is assumed that disposal costs are equal to placement costs.

SUMMARY

Improvements to the Outer Harbor necessary for safe and efficient operation of 1,000-foot and 1,200-foot vessels are limited to four major areas. These areas include 1) East Breakwater removal, 2) Outer Breakwater construction, 3) Dredging, and 4) Marina Breakwater construction. Each is summarized below as well as shown on Plate 2-1.

1) Remove 600 feet of the East Breakwater and relocate breakwater light at a 1979 estimated cost of $1.3 million. This will allow for the larger vessels to easily steer into position to move upriver or into a Lakefront transshipment facility.

2) Add 600 feet of cellular sheet pile breakwater to the eastern end of the Outer Breakwater. Estimated cost of this construction is $1.2 million.

3) Deepen the navigation channel and turning areas of the Outer Harbor at a cost of approximately $2.8 million. This cost will be to lower the harbor depth by approximately three feet due to increased static drift, squat, roll and pitch of large vessels. Dredging costs between the 1,000-foot vessel option and the 1,200-foot vessel option are negligible.

4) A 400 to 500 recreational craft marina can be accommodated along the East Shorearm Breakwater. If the cut is constructed through Riverside Park, a protective rubblemound breakwater must be constructed at a cost of approximately $1.3 million.

RECOMMENDATIONS

Preliminary design analysis has resulted in the following conclusions:

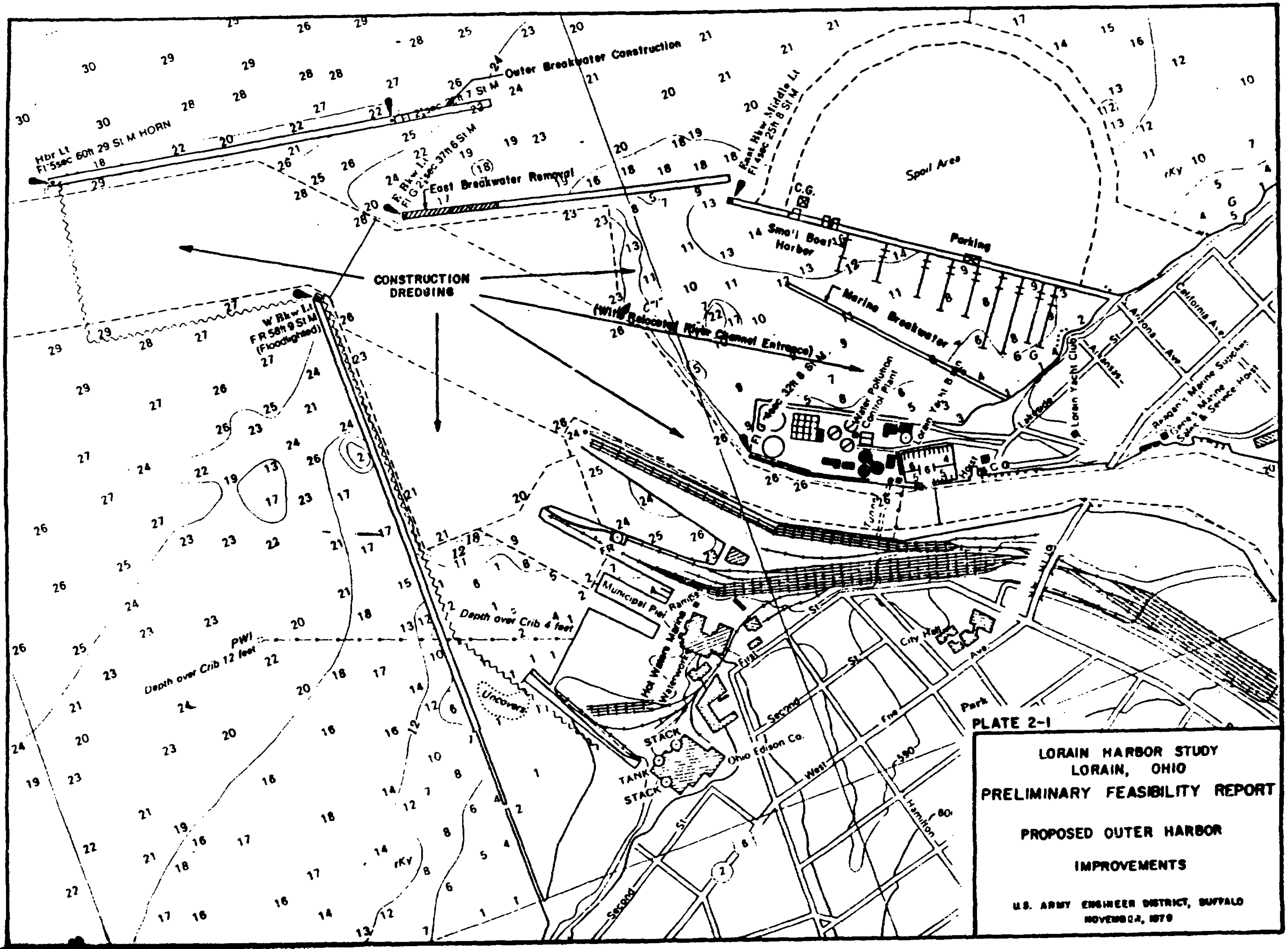
- Although 1,000-foot vessels can use the existing harbor facilities, some Outer Harbor navigational improvements will improve their operational efficiencies by allowing for increased static drafts.

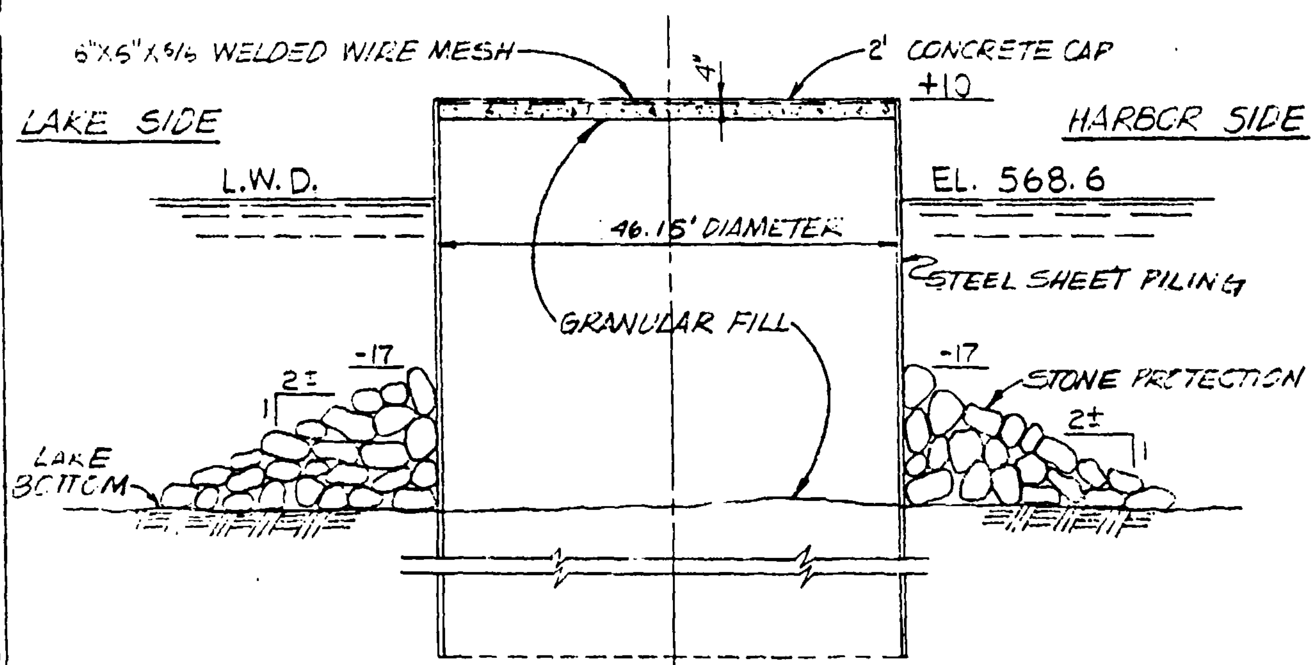
- Both 1,000-foot and 1,200-foot vessels can be accommodated in Lorain Outer Harbor with the same modifications.

- Breakwater modification requirements include removing 600 feet of the East Breakwater and lengthening the Outer Breakwater by 600 feet.

- Overall, the Outer Harbor channel depth must be increased by three feet.

- A future recreational marina can be accommodated along the East Breakwater Shorearm and Dike Disposal Area. This marina will require a protective breakwater regardless of the location of commercial navigation activity in the harbor. However, with a river channel entrance relocated through Riverside Park, a more substantial breakwater is necessary to protect the small craft from the large vessel backwash and the open lake.


Outer Breakwater Construction
East Breakwater Removal
CONSTRUCTION DREDGING
(With Relocated River Channel Entrance)
Spoil Area
Small Boat Harbor
Parking
Marine Breakwater
Water Pollution Control Plant
Lorain Yacht Club
Municipal Pier
Depth over Crib 4 feet
Depth over Crib 12 feet
Uncovers
Ohio Edison Co.
STACK
TANK
City Hall
Hbr Lt Fl 5sec 60ft 29 St M HORN
W Bkw Lt F R 58ft 9 St M (Floodlighted)
E Bkw Lt Fl G 2sec 37ft 6 St M
East Hbr Middle Lt Fl 4sec 25ft 8 St M
PLATE 2-1
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
PROPOSED OUTER HARBOR
IMPROVEMENTS
U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979



TYPICAL SECTION

PLATE 2-2

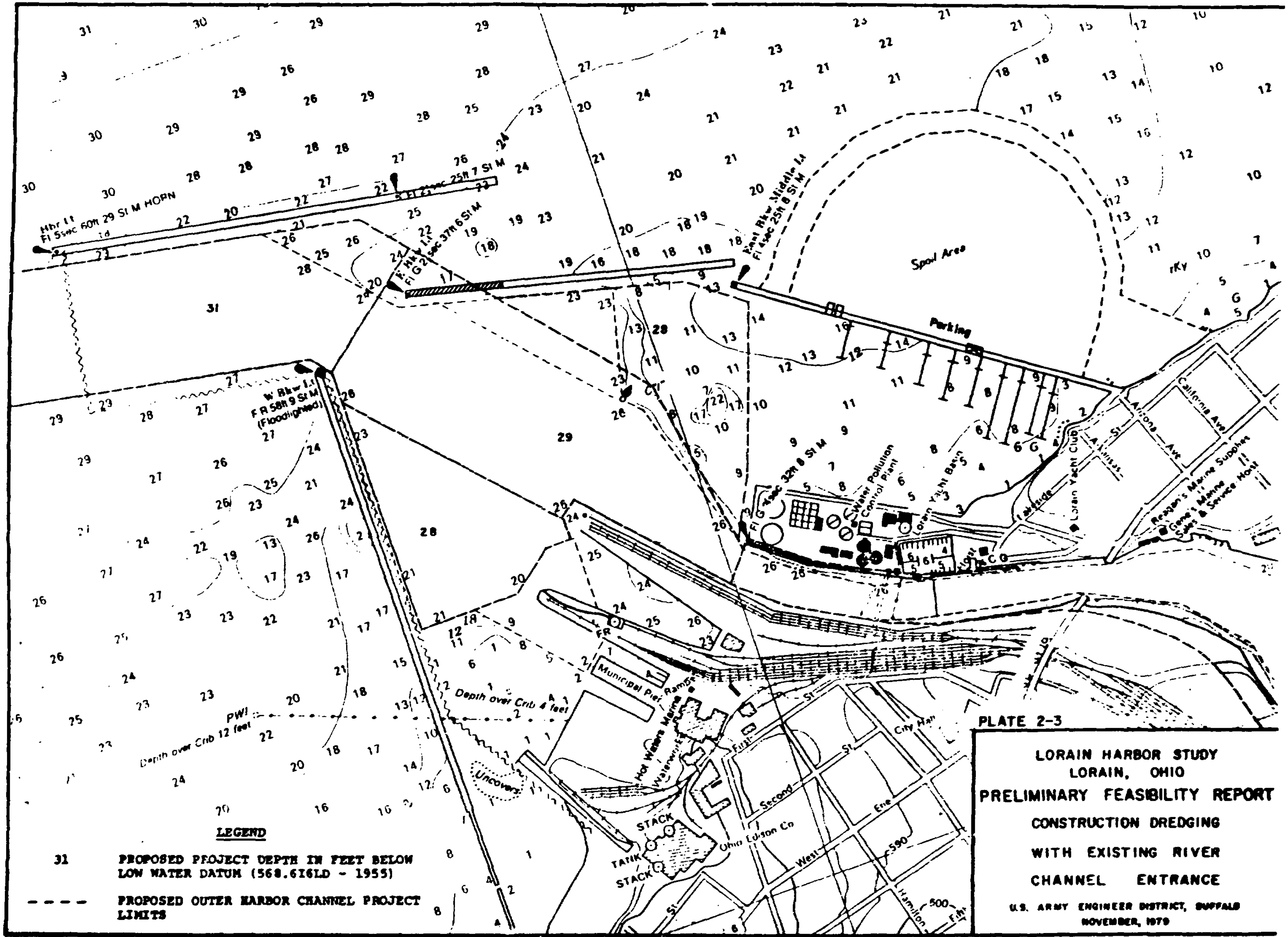
LORAIN HARBOR STUDY
LORAIN, OHIO

PRELIMINARY FEASIBILITY REPORT

PROPOSED OUTER BREAKWATER ADDITION

U.S. ARMY ENGINEER DISTRICT, BUFFALO

F.R.



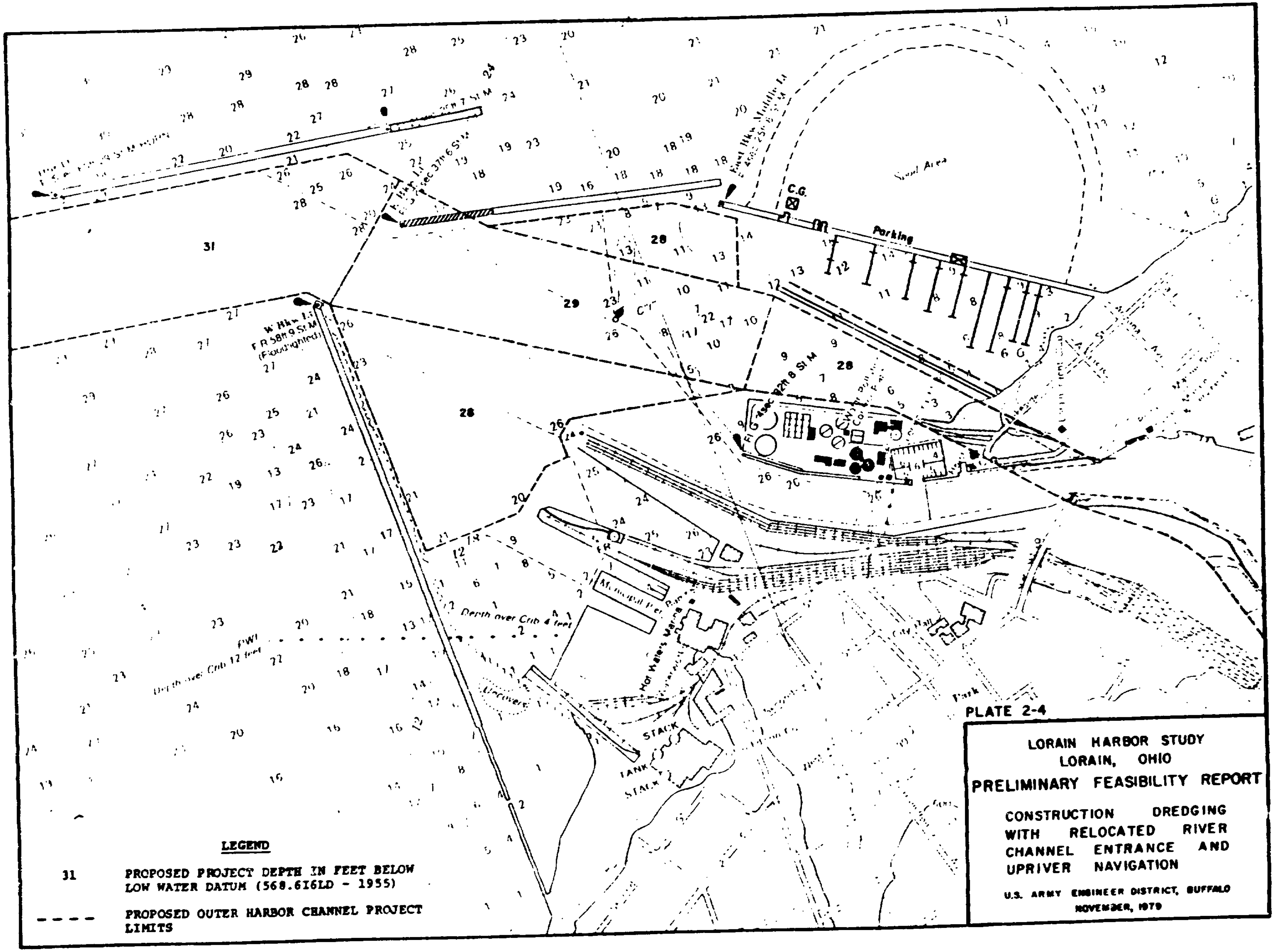
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
CONSTRUCTION DREDGING
WITH EXISTING RIVER
CHANNEL ENTRANCE

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979

LEGEND

31 PROPOSED PROJECT DEPTH IN FEET BELOW LOW WATER DATUM (568.6 IGLD - 1955)

- - - - PROPOSED OUTER HARBOR CHANNEL PROJECT LIMITS



LEGEND

31 PROPOSED PROJECT DEPTH IN FEET BELOW LOW WATER DATUM (568.6I6LD - 1955)

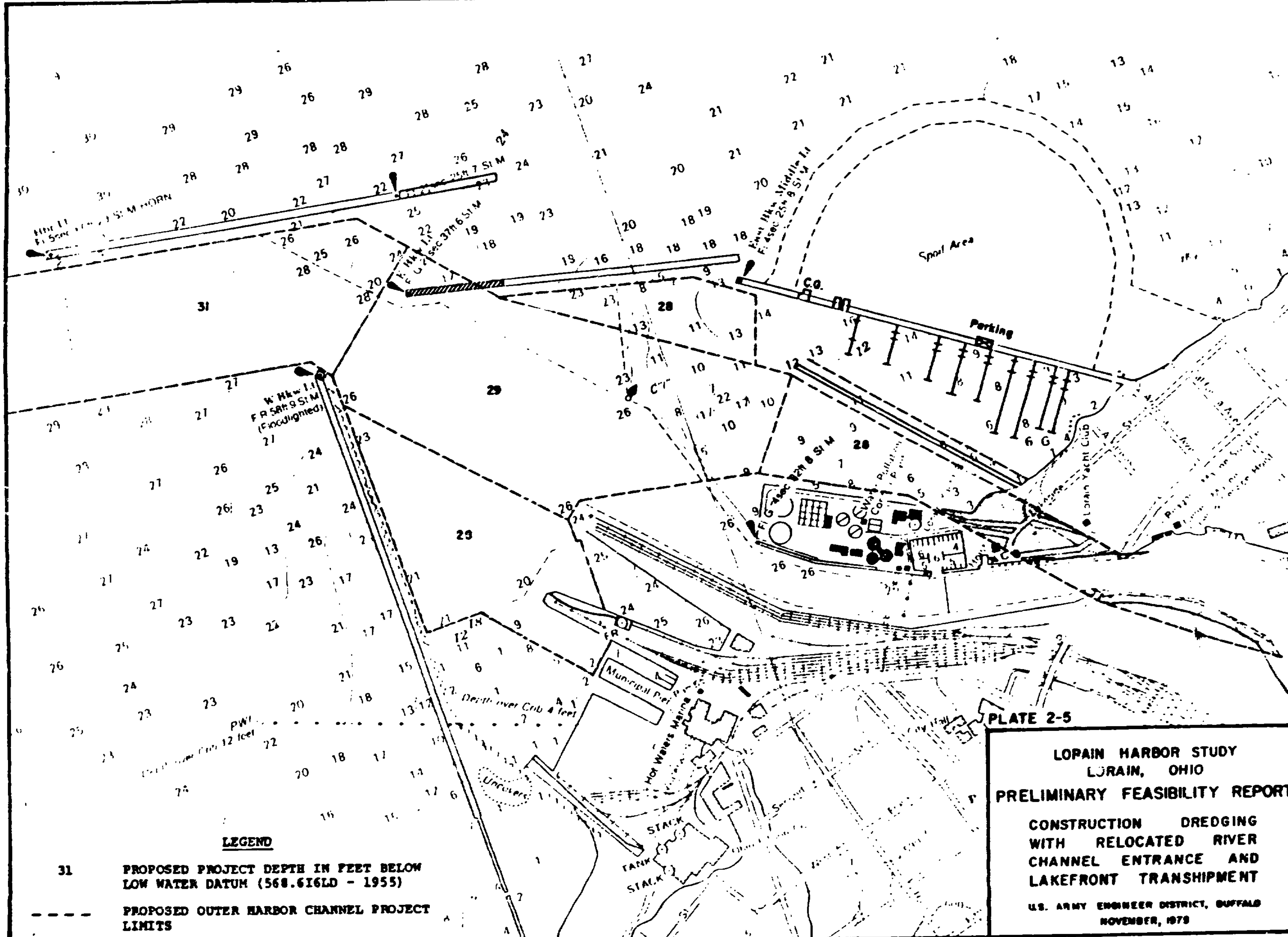
- - - - PROPOSED OUTER HARBOR CHANNEL PROJECT LIMITS

PLATE 2-4

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

CONSTRUCTION DREDGING WITH RELOCATED RIVER CHANNEL ENTRANCE AND UPRIVER NAVIGATION

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979



LEGEND

31 PROPOSED PROJECT DEPTH IN FEET BELOW LOW WATER DATUM (568.6IGLD - 1955)

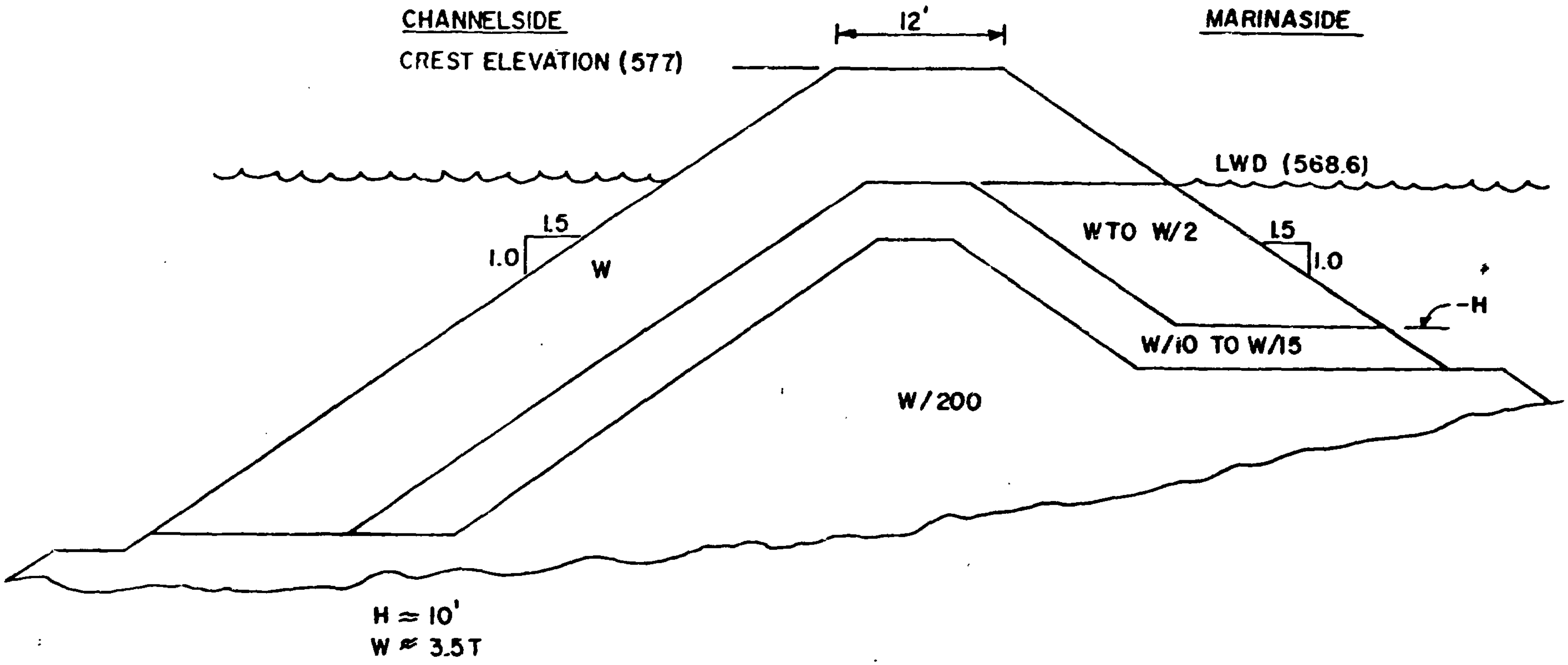
- - - - PROPOSED OUTER HARBOR CHANNEL PROJECT LIMITS

PLATE 2-5

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

CONSTRUCTION DREDGING WITH RELOCATED RIVER CHANNEL ENTRANCE AND LAKEFRONT TRANSHIPMENT

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979



TYPICAL SECTION

PLATE 2-6

LORAIN HARBOR STUDY
LORAIN, OHIO

PRELIMINARY FEASIBILITY REPORT

PROPOSED RUBBLEMOUND MARINA BREAKWATER

U.S. ARMY ENGINEER DISTRICT, BUFFALO

SECTION 3 - CHANNEL IMPROVEMENTS ON BLACK RIVER

GENERAL

Scope. The channel improvements on the Black River are proposed to allow both efficient and safe navigation of 1,000- and 1,200-foot vessels on a regular basis. Presently ships up to the Class VII size (700-730 feet long) can operate on the river without assistance.

The proposed channel improvements on the Black River consist of three basic concepts: (1) to allow the design vessels to navigate to the American Shipbuilding Docks, (2) to allow the design vessels to navigate to the Lower Turning Basin, and (3) to allow the design vessels to navigate to the Upper Turning Basin.

The channel improvements may be separated into three basic categories: (1) channel deepening, (2) channel widening, and (3) erosion protection for channel banks. The existing navigation channel of the Black River is dredged to a depth of 27 feet below low water datum (568.6 feet on International Great Lakes Datum - 1955). With the larger design vessels (1,000-and 1,200-foot), the channel depth required would be 28 feet. Therefore, an additional one foot of dredging would be necessary. The larger beams and greater length on the design vessels require a wider channel for safe navigation and therefore extensive channel widening would be necessary. Also, due to the waves created by the design vessels with bow and stern thrusters, bank protection must be provided in the critical areas subject to these waves and their velocities. The type of erosion protection considered for this study was steel sheet pile because it provides the most practical protection at the most economical cost.

Criteria. The channel design for this study was based upon "Chapter X - Design of Channels for Navigation" from the United States Army Engineers Tidal Hydraulics Committee, Report No. 3, 1965. Also used in the design determinations were the experiences and recommendations of vessel masters who are familiar with navigation on the Black River. In addition to both of the above, rough scale models of 1,000- and 1,200-foot vessels were used to study maneuvering problems through the channel. Channel design can vary widely depending on the criteria and assumptions used in the design. Table 3.1 shows the major characteristics of the design vessels. The existing channel is only wide enough for one-way traffic for large vessels. For economical reasons, one-way vessel traffic was considered in the design of the proposed channel. Vessel speed was assumed to be moderate (approximately 5 knots) and controllability of the vessels was considered very good. Most of the design vessels considered are equipped with twin screws and bow and stern thrusters which enables them to maneuver very well.

TABLE 3.1 CHARACTERISTICS OF DESIGN VESSELS

Characteristics	1,000-Foot	1,200-Foot
Length	1,000'	1,000'
Beam	105'	130'
Draft	28'	28'
Height above water	125'	135'

The required channel widths were comprised of a maneuvering lane width, a width for bank clearance on each side of the maneuvering lane, and additional widening for bends. The maneuvering lane width is required for the vessel to maneuver without encroaching on the safe bank clearance. The width for bank clearance is necessary to reduce the bank suction force between the vessel and the channel banks. The minimum

channel widths determined were 300 and 370 feet respectively for 1,000-foot and 1,200-foot vessels in a straight channel (see Plate 3-1). However, the curved alignment of the Black River required that much of the channel be over 400 feet wide.

The design of the turning basins was based on the length of the design vessels and the required clearance fore and aft to turn without assistance. The design radii for the turning basins was 200 feet plus the length of the design vessel. Considering the vessel maneuverability and suggestions of vessel masters this radii was selected as the minimum for design.

EVALUATION

Navigation of a 1,000- or 1,200-foot vessel up the existing Black River channel would not be possible because of narrow channel widths in several locations. Access to the Black River from the Outer Harbor may be either through the existing channel or through a new channel cut through Riverside Park. The channel through Riverside Park (Cut A - Plates 3-2 and 3-3) would allow the design vessels to pass through the existing Erie Avenue bascule bridge. Cut A would be 300 or 370 feet wide for 1,000- or 1,200-foot vessels respectively and would have vertical banks protected by steel sheet pile. Access through the existing channel would require either a new tunnel, a high level bridge or a movable bridge to replace the existing Erie Avenue Bridge. The existing bridge would be replaced since the channel width would be insufficient to pass the design vessels due to the bridge being skewed to the channel. For vessels to pass through the existing channel additional cuts (Cut B - Plates 3-2 and 3-3) would be required on both sides of the river downstream of Erie Avenue. The channel widening

required for Cut B would be protected by steel sheet pile similar to the existing channel.

Due to the restriction at Erie Avenue and the right hand curve past the American Shipbuilding docks, a major cut (Cut C - Plates 3-2 and 3-3) is necessary along the south side of the river from the Erie Avenue Bridge to the Norfolk and Western Railroad Bridge. The magnitude of Cut C would depend on the distance upriver that the vessel would travel. Cut C-1 allows the design vessel to navigate to the American Shipbuilding Docks. Cut C-2 area enables the design vessels to clear the Erie Avenue Bridge and make their approach to the railroad bridge. Excavation for Cut C was based on 2 horizontal to 1 vertical slopes and, therefore, steel sheet pile was not included for bank protection except in critical areas where bow and stern thrusters may cause bank erosion. Sheet pile protection for the other cuts upriver was based on these same considerations.

Once the vessels have passed through the railroad bridge they must navigate through a rather sharp curve to the right before reaching the Lower Turning Basin. Therefore, another major cut (Cut D - Plates 3-2 and 3-3) must be made along the southwest side of the river immediately upstream of the railroad bridge. Cuts would also be necessary on the northeast side of the river at the Lower Turning Basin below the 21st Street Bridge. The magnitude of the cut (Cut E - Plates 3-2 and 3-3) would depend on whether design vessels were passing through the turning basin (Cut E-1) or negotiating a 180 degree turn (Cut E-2) to head downriver.

Another major cut (Cut F - Plates 3-2 and 3-3) would be required on the southwest side of the river immediately upstream of the 21st Street Bridge. This cut would enable the vessels to clear the 21st Street Bridge and make their

approach to the Upper Turning Basin. The final cut area (Cut G - Plates 3-2 and 3-3) required would be on the north side of the river at the Upper Turning Basin to allow the design vessels to turn 180 degrees and return downriver.

These cuts are required as a result of the extra length of the design vessels and the rather sharp curves that they must negotiate in navigating the river. The excellent maneuverability of the vessels with twin screws and rudders along with bow and stern thrusters would make it possible to navigate the river with the proposed improvements.

COST ESTIMATES

Cost estimates are listed in Table 3.2 and 3.3 for both 1,000- and 1,200-foot vessels respectively as a total cost associated with each cut area. The cost for each cut is subdivided into costs for bank cuts and deepening bank protection, land acquisition, utility relocation, building demolition and relocation, and other miscellaneous costs.

Cost estimates are also listed for two options: Option 1 - 1,000-foot vessels and Option 2 - 1,200-foot vessels in Table 3.4 and 3.5 respectively. Within each option, costs are divided into five navigation concepts which are based on the distance upstream on the Black River that the design vessels would travel. Each cost estimate is further subdivided into three section: (1) from the mouth of the Black River to American Shipbuilding Docks, (2) from American Shipbuilding Docks to the Lower Turning Basin, and (3) from the Lower Turning Basin to the Upper Turning Basin.

Cost estimates for excavation were based upon the assumption that all excavated material would have to be trucked off site within a 15-mile radius for disposal.

Diked disposal and open lake dumping were not considered as likely methods of disposing of the potentially polluted material due to environmental constraints. Land acquisition costs for each channel cut was based upon the land area from the existing harbor line to the top of bank for each proposed cut. Building demolition and relocation costs were estimated based upon the use of aerial photographs and field reconnaissance. The cut through Riverside Park (Cut A) would require relocation of the Coast Guard facility. One possible location for this facility, which was selected for this preliminary study, would be leeward of the diked disposal area. Utility relocation costs were estimated by using utility maps provided by the City of Lorain along with information provided by utility companies. Costs for erosion protection of channel banks were based on the use of steel sheet pile protection. Sheet pile protection was selected based upon recommendations of vessel masters, ease of installation, and their proven effectiveness in the Lorain area. The critical areas exposed to wave action and erosion from bow thrusters and propellers were determined by estimating the maneuvers of the design vessels in navigating both upstream and downstream.

SUMMARY

The proposed channel improvements for the Black River are necessary if the larger vessels operating on the Great Lakes are to navigate the river. The channel improvements are proposed to allow the design (1,000-foot or 1,200-foot) vessels to navigate up river to three different points. In order for vessels to navigate the entire 3 miles of the river, major channel widening and deepening will be required due to the increased length and width of the vessels and the curves of the channel. However, the extremely good maneuverability of the design vessels with twin screws and bow and stern thrusters reduce the extent of channelization for these cuts.

Cost estimates for each design vessel for the different alternates were developed. The estimates include costs for excavation, bank protection, utility relocation, land acquisition and other minor associated costs.

RECOMMENDATIONS

Although steel pile protection is recommended in areas where bank erosion was determined to be most critical, additional sheet pile protection in conjunction with future commercial docking facilities may be worth considering. This possibility was not addressed as it is beyond the scope of this preliminary study.

Although the cost difference would not be appreciable, it is recommended and was estimated as part of this study that access to the treatment plant for alternatives that contain the Cut through Riverside Park be provided by a sheet piled fill across the existing Black River channel. Blocking the existing channel is recommended so that the main flow would exit through the new cut thereby reducing the sedimentation in the channel. To avoid creating a stagnant pool in the existing channel, a pipe culvert should be included with the sheet pile fill to allow some flow to continually exit through the existing channel along the west side of the treatment plant.

TABLE 3.2 - OPTION 1: 1,000-FOOT VESSELS
SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS
BY CUT AREAS

Cut Area	Item	Quantity	Unit	Unit Price	Cost
Cut A	Bank Cuts and Deepening	269,500	C.Y.	$13.00	$ 3,503,500
	Bank Protection	2300 Bank-Ft.	L.S.		1,626,000
	Land Acquisition	5.40	Acres	$90,000	486,000
	Utility Relocation		L.S.		1,010,000
	Building Demolition and Relocation		L.S.		1,000,000
	Other				8,000
				Total	$ 7,633,500
				Say	$7.6 million
Cut B	Bank Cuts and Deepening	118,400	C.Y.	$13.00	$ 1,539,200
	Bank Protection	930 Bank-Ft.	L.S.		996,000
	Land Acquisition	4.88	Acres	$90,000	439,000
	Utility Relocation		L.S.		5,000
	Building Demolition		L.S.		32,000
				Total	$ 3,011,200
				Say	$3.0 million
Cut C-2	Bank Cuts and Deepening	645,800	C.Y.	$13.00	$ 8,395,400
	Bank Protection	1300 Bank-Ft.	L.S.		910,000
	Land Acquisition	15.27	Acres	$90,000	1,377,000
	Utility Relocation		L.S.		18,000
				Total	$10,700,400
				Say	$10.7 million
Cut C-1	Bank Cuts and Deepening	187,300	C.Y.	$13.00	$ 2,434,900
	Land Acquisition	5.20	Acres	$90,000	468,000
				Total	$ 2,902,900
				Say	$2.9 million
Cut D	Bank Cuts and Deepening	660,450	C.Y.	$13.00	$ 8,585,850
	Bank Protection	1200 Bank-Ft.	L.S.		840,000
	Land Acquisition	12.51	Acres	$90,000	1,125,000
	Building Demolition		L.S.		60,000
				Total	$10,610,850
				Say	$10.6 million

TABLE 3.2
(Continued)

Cut Area	Item	Quantity	Unit	Unit Price	Cost
Cut E-1	Bank Cuts and Deepening	327,050	C.Y.	$13.00	$ 4,251,650
	Bank Protection	700 Bank-Ft.	L.S.		490,000
	Land Acquisition	6.54	Acres	$90,000	588,600
				Total	$ 5,330,250
				Say	$5.3 million
Cut E-2	Bank Cuts and Deepening	611,450	C.Y.	$13.00	$ 7,948,850
	Bank Protection	700 Bank-Ft.	L.S.		490,000
	Land Acquisition	10.79	Acres	$90,000	972,000
				Total	$ 9,410,850
				Say	$9.4 million
Cut F	Bank Cuts and Deepening	755,150	C.Y.	$13.00	$ 9,816,950
	Land Acquisition	10.27	Acres	$90,000	927,000
				Total	$10,743,950
				Say	$10.7 million
Cut G	Bank Cuts and Deepening	986,150	C.Y.	$13.00	$12,819,950
	Bank Protection	600 Bank-Ft.	L.S.		420,000
	Land Acquisition	16.70	Acres	$90,000	1,503,000
				Total	$14,742,950
				Say	$14.7 million

TABLE 3.3 - OPTION 2: 1,200-FOOT VESSELS
SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS
BY CUT AREAS

Cut Area	Item	Quantity	Unit	Unit Price	Cost
Cut A	Bank Cuts and Deepening	367,000	C.Y.	$13.00	$ 4,771,000
	Bank Protection	2300 Bank-Ft.	L.S.		1,626,000
	Land Acquisition	6.88	Acres	$90,000	619,200
	Utility Relocation		L.S.		1,020,000
	Building Demolition and Relocation		L.S.		1,575,000
	Other				8,000
				Total	9,619,200
				Say	$9.6 million
Cut B	Bank Cuts and Deepening	373,000	C.Y.	$13.00	$ 4,849,000
	Bank Protection	3100 Bank-Ft.	L.S.		1,620,500
	Land Acquisition	9.76	Acres	$90,000	878,400
	Utility Relocation		L.S.		10,000
	Building Demolition		L.S.		32,000
				Total	$ 7,389,900
				Say	$7.4 million
Cut C-1	Bank Cuts and Deepening	187,300	C.Y.	$13.00	$ 2,434,900
	Land Acquisition	5.20	Acres	$90,000	468,000
				Total	$ 2,902,900
				Say	$2.9 million
Cut C-2	Bank Cuts and Deepening	681,900	C.Y.	$13.00	$ 8,864,700
	Bank Protection	1800 Bank-Ft.	L.S.		1,120,000
	Land Acquisition	15.84	Acres	$90,000	1,425,600
	Utility Relocation		L.S.		30,000
				Total	$11,440,300
				Say	$11.4 million
Cut D	Bank Cuts and Deepening	660,450	C.Y.	$13.00	$ 8,585,850
	Bank Protection	1200 Bank-Ft.	L.S.		840,000
	Land Acquisition	12.5	Acres	$90,000	1,125,000
	Building Demolition		L.S.		60,000
				Total	$10,610,850
				Say	$10.6 million

TABLE 3.3
(Continued)

Cut Area	Item	Quantity	Unit	Unit Price	Cost
Cut E-1 and Cut E-2	Bank Cuts and Deepening	910,450	C.Y.	$13.00	$11,835,850
	Bank Protection	1000 Bank-Ft.	L.S.		724,000
	Land Acquisition	16.39	Acres	$90,000	1,475,100
				Total	$14,034,950
				Say	$14.0 million
Cut F	Bank Cuts and Deepening	755,150	C.Y.	$13.00	$ 9,816,950
	Land Acquisition	10.27	Acres	$90,000	924,300
				Total	$10,741,250
				Say	$10.7 million
Cut G	Bank Cuts and Deepening	1,206,450	C.Y.	$13.00	$15,683,850
	Bank Protection	600 Bank-Ft.	L.S.		420,000
	Land Acquisition	17.77	Acres	$90,000	1,599,300
				Total	$17,703,150
				Say	$17.7 million

TABLE 3.4 - OPTION 1: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,000-FOOT VESSELS

A. Navigation Concept: To Upper Turning Basin W/Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts A, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-1)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts F, G)	Total Costs
Bank Cuts, Deepening and Protection	$14.4	$14.2	$23.1	$51.7
Building Demolition and Relocation	1.0	0.1	--	1.1
Land	1.9	1.7	2.4	6.0
Utilities	1.0	--	--	1.0
Total	$18.3	$16.0	$25.5	$59.8

TABLE 3.4 - OPTION 1: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,000-FOOT VESSELS

B. Navigation Concept: To Upper Turning Basin W/O Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts B, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-1)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts F, G)	Total Costs
Bank Cuts, Deepening and Protection	$11.8	$14.2	$23.1	$49.1
Building Demolition and Relocation	--	0.1	--	0.1
Land	1.8	1.7	2.4	5.9
Utilities	--	--	--	--
Total	$13.6	$16.0	$25.5	$55.1

TABLE 3.4 - OPTION 1: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,000-FOOT VESSELS

C. Navigation Concept: To Lower Turning Basin W/Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts A, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-2)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts --)	Total Costs
Bank Cuts, Deepening and Protection	$14.4	$17.8	$ --	$32.2
Building Demolition and Relocation	1.0	0.1	--	1.1
Land	1.9	2.1	--	4.0
Utilities	1.0	--	--	1.0
Total	$18.3	$20.0	$ --	$38.3

TABLE 3.4 - OPTION 1: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,000-FOOT VESSELS

D. Navigation Concept: To Lower Turning Basin W/O Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts B, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-2)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts --)	Total Costs
Bank Cuts, Deepening and Protection	$11.8	$17.8	$ --	$29.6
Building Demolition and Relocation	--	0.1	--	0.1
Land	1.8	2.1	--	3.9
Utilities	--	--	--	--
Total	$13.6	$20.0	$ --	$33.6

TABLE 3.4 - OPTION 1: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,000-FOOT VESSELS

E. Navigation Concept: To Amship W/Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts A, C-1)	Costs (Millions) Amship to Lower Turning Basin (Cuts --)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts --)	Total Costs
Bank Cuts, Deepening and Protection	$ 7.6	$ --	$ --	$ 7.6
Building Demolition and Relocation	1.0	--	--	1.0
Land	1.0	--	--	1.0
Utilities	1.0	--	--	1.0
Total	$10.6	$ --	$ --	$10.6

TABLE 3.5 - OPTION 2: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,200-FOOT VESSELS

A. Navigation Concept: To Upper Turning Basin W/Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts A, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-1)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts F, G)	Total Costs
Bank Cuts, Deepening and Protection	$16.4	$22.0	$25.9	$64.3
Building Demolition and Relocation	1.6	0.1	--	1.7
Land	2.0	2.6	2.5	7.1
Utilities	1.1	--	--	1.1
Total	$21.1	$24.7	$28.4	$74.2

TABLE 3.5 - OPTION 2: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,200-FOOT VESSELS

B. Navigation Concept: To Upper Turning Basin W/O Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts B, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-1)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts F, G)	Total Costs
Bank Cuts, Deepening and Protection	$16.5	$22.0	$25.9	$64.4
Building Demolition and Relocation	--	0.1	--	0.1
Land	2.3	2.6	2.5	7.4
Utilities	--	--	--	--
Total	$18.8	$24.7	$28.4	$71.9

TABLE 3.5 - OPTION 2: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,200-FOOT VESSELS

C. Navigation Concept: To Lower Turning Basin W/Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts A, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-2)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts --)	Total Costs
Bank Cuts, Deepening and Protection	$16.4	$22.0	$ --	$38.4
Building Demolition and Relocation	1.6	0.1	--	1.7
Land	2.0	2.6	--	4.6
Utilities	1.1	--	--	1.1
Total	$21.1	$24.7	$ --	$45.8

TABLE 3.5 - OPTION 2: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,200-FOOT VESSELS

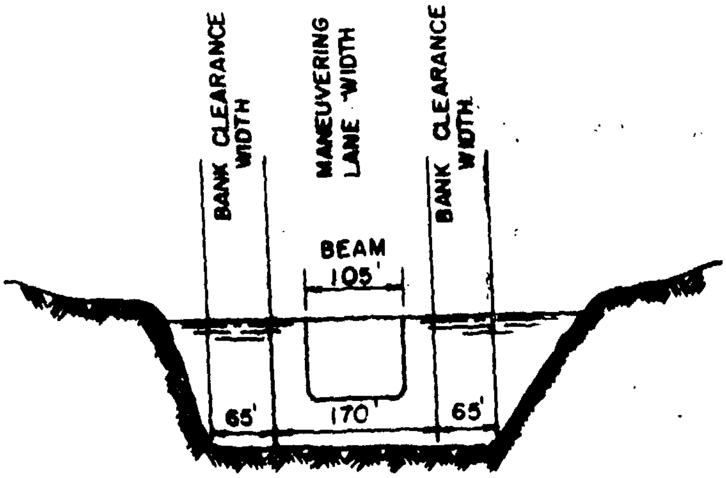
D. Navigation Concept: To Lower Turning Basin W/O Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts B, C-2)	Costs (Millions) Amship to Lower Turning Basin (Cuts D, E-2)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts --)	Total Costs
Bank Cuts, Deepening and Protection	$16.5	$22.0	$ --	$38.5
Building Demolition and Relocation	--	0.1	--	0.1
Land	2.3	2.6	--	4.9
Utilities	--	--	--	--
Total	$18.8	$24.7	$ --	$43.5

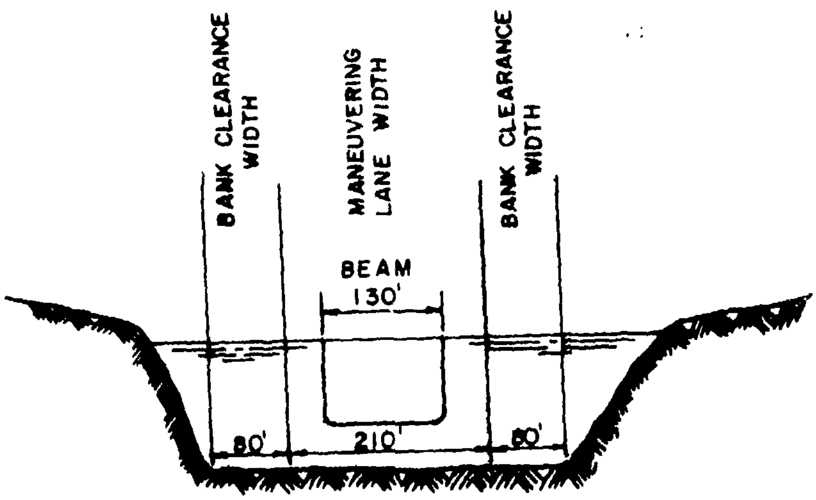
TABLE 3.5 - OPTION 2: SUMMARY OF BLACK RIVER CHANNEL IMPROVEMENT COSTS FOR 1,000-FOOT VESSELS

E. Navigation Concept: To Amship W/Riverside Park Cut

Construction Item	Costs (Millions) Mouth of Black River to Amship (Cuts A, C-1)	Costs (Millions) Amship to Lower Turning Basin (Cuts --)	Costs (Millions) Lower Turning Basin to Upper Turning Basin (Cuts --)	Total Costs
Bank Cuts, Deepening and Protection	$ 8.8	$ --	$ --	$ 8.8
Building Demolition and Relocation	1.6	--	--	1.6
Land	1.1	--	--	1.1
Utilities	1.0	--	--	1.0
Total	$12.5	$ --	$ --	$12.5



CHANNEL WIDTHS FOR 1000 FOOT VESSEL
STRAIGHT CHANNEL



CHANNEL WIDTHS FOR 1200 FOOT VESSEL
STRAIGHT CHANNEL

PLATE 3-1

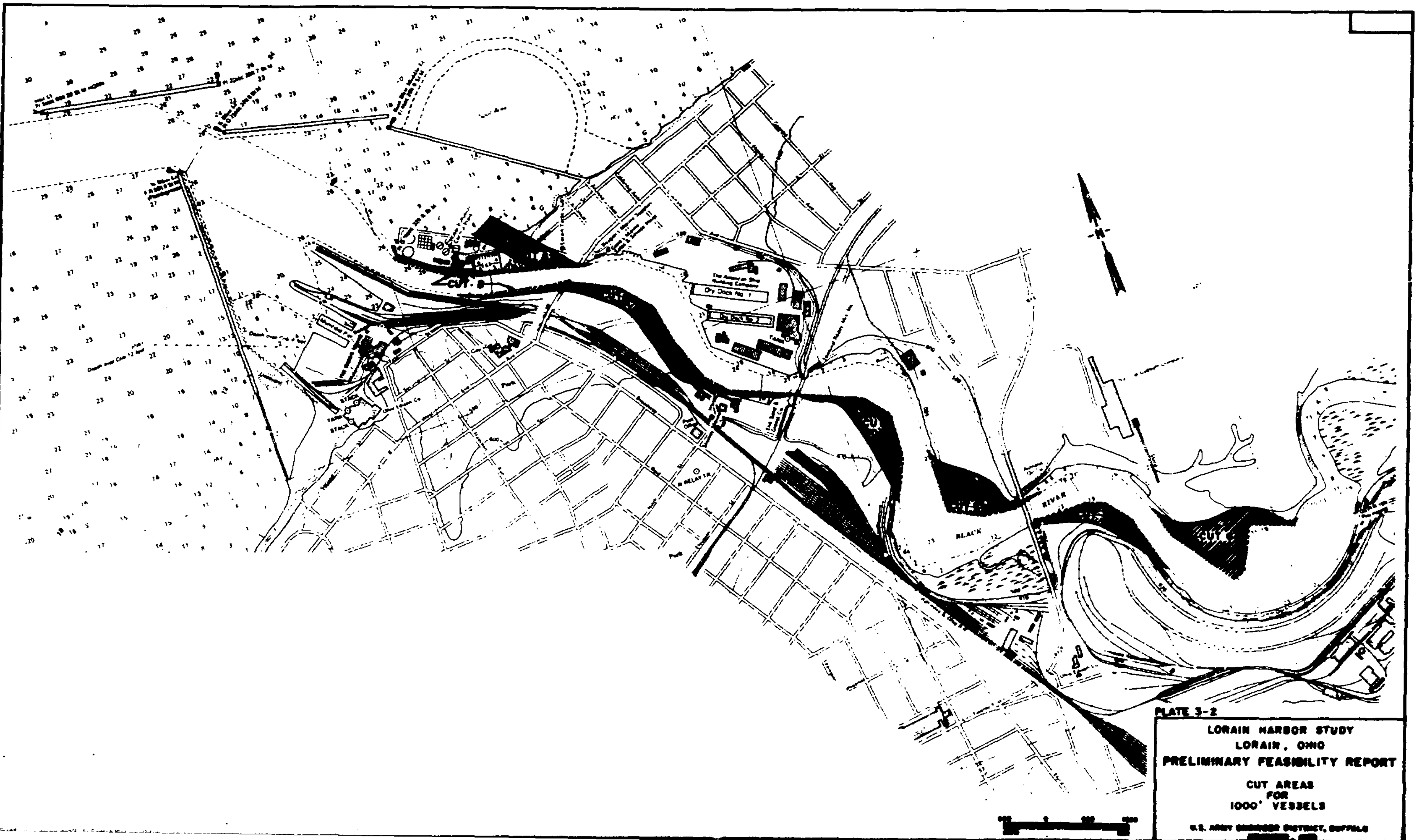


PLATE 3-2

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

CUT AREAS
FOR
1000' VESSELS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE 3-3

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

CUT AREAS
FOR
1000' VESSELS

SECTION 4 - BRIDGES

GENERAL

Scope. Passage of 1,000-foot or 1,200-foot vessels up the Black River requires 125- or 135-foot understructure vertical clearance above water surface and 300- or 370-foot channel widths respectively. None of the three existing bridges fully meets proposed requirements. Specific bridge items to be considered are:

(a) A high level fixed span replacement for the Erie Avenue bascule bridge.

(b) A movable bridge replacement for the Erie Avenue bascule bridge.

(c) A tunnel replacement for the Erie Avenue Bridge (discussed in Section 5).

(d) Modification to the existing N&W Railroad lift bridge to provide an additional 12 feet of vertical clearance. This is required for the 1,200-foot vessel only.

(e) Considerations regarding horizontal clearance at the existing N&W bridge.

(f) Raising or replacement of the existing 21st Street Bridge.

Criteria.

(a) Location: Criteria for structure location are not absolutes but goals that are traded off to obtain the best balance. The goals are:

(1) To provide maximum accessibility and adequate capacity.

(2) To minimize permanent adverse effect on property and established activities.

(3) To maintain acceptable traffic patterns and capacity during construction.

(b) Vertical and Horizontal Alignment: Ohio Department of Transportation Classification "UA" (Principal Urban Arterial) was used. Specific criteria are:

(1) Design Speed: 50 MPH

(2) Curves: 7°-30' max.; 3° desirable

(3) Grade: 6% max.; 0.24% min.

(4) Stopping Sight Distance: 350' min.'; 450 desirable.

ERIE AVENUE BRIDGE

Existing Bridge. The existing structure has a total length of about 1,050 feet and consists of a twin-leaf bascule main span with eight steel girder approach spans on the west and one approach span on the east. The structure carries two, 22-foot roadways separated by a three-foot median and two, seven-foot-wide sidewalks. The main span is 295 feet long and provides approximately 147.5 feet horizontal clearance, 96 feet above mean water elevation when open. Traffic delays for each vessel passage average seven to eight minutes with 12 minutes as a normal maximum delay.

ERIE AVENUE HIGH LEVEL BRIDGE REPLACEMENT

EVALUATION

Location. There is no ideal location for a high level structure in the vicinity of the present Erie Avenue structure. Due to the level terrain on each side of the river, long approaches are required to attain understructure clearance while conforming to the grade criteria. An alignment near the water's edge at the mouth of the Black River conflicts with major existing plants and activities. Locations upstream (south of the existing Erie Avenue Bridge) conflict with a developed commercial area and would have longer river crossing spans. Placing the main spans at other than a right angle to the river would increase main span length. Building the approach spans on a tight curve is generally considered questionable design. The location chosen (see Plate 4-1) places the south approach and main spans on a tangent extension of Erie Avenue south of Oberlin and requires only two short three degree curves to get back on the line of Erie Avenue near Delaware Street.

Structure Type. A three-span continuous through truss main structure is usually the most economical choice for the span length required when understructure clearance is of primary consideration. The deck girder approach spans are most economical for the shorter spans where understructure clearance is not a controlling factor. Pier spacing can be adjusted to minimize interference with existing facilities and still have a balanced and pleasing appearance. The four 12-foot lanes with an eight-foot medial reservation, a [illegible]al barrier and eight-foot shoulders is fairly standard. T[illegible] [illegible]edial reservation, medial barrier and shoulders are p[illegible]cularly desirable for this structure because of the

length of overall structure and included curves. A six-foot-wide pedestrian walk was included but due to the length and location of access would probably not be very popular or much used. Placing the walk under the deck where it could also be used to inspect the structure could be considered.

Traffic. Through or cross-town traffic would move more freely over a route of virtually unchanged length. The structure grades would have some adverse effect, but there would be no intersections or stoppages for passage of river vessels. Local traffic would be adversely affected in some cases due to the widely separated points of access to the bridge. The existing structure would remain in service until the new bridge was open to traffic. Interference with traffic during construction would be minimal and mostly on side streets.

Other Impacts. It is anticipated that the land under and immediately adjacent to the bridge would be permanently vacated, and could not be used for any commercial, industrial or residential purposes. The amount of land so affected will be substantial, varying to some slight degree depending on the exact location of the structure in relation to property lines. With 125- or 135-foot clearance, the top of the center span truss will be in the order of 200 feet above water. The total structure is in the order of 5,000 feet in length. In combination with the level terrain these factors indicate the structure will visually dominate the surrounding area. This effect is difficult to quantify in any terms that can be compared to and traded off with user benefits and construction dollars. However, it is expected there will be objections to this type of bridge, making the selection of a high level bridge for Erie Avenue highly questionable.

COST ESTIMATE

TABLE 4.1 COST ESTIMATE FOR ERIE AVENUE HIGH LEVEL BRIDGE

	Quantity	Unit	Unit Price	Cost
1,000-Foot Vessels				
Structure:				
Superstructure	266,000	Sq.Ft.	$85	$22,600,000
Substructure	266,000	Sq.Ft.	$20	5,400,000
Remove Existing Structure	--	L.S.	--	3,500,000
Maintenance and Protection of Traffic	--	L.S.	--	60,000
Streets and Approaches	13,000	S.Y.	80	1,040,000
Subtotal, Structure				32,600,000
Utility Costs				650,000
Land Costs				4,750,000
TOTAL, 1,000-Foot Vessel				$38,000,000
1,200-Foot Vessels				
Superstructure	280,000	Sq.Ft.	$85	$23,800,000
Streets and Approaches	10,500	S.Y.	80	840,000
(All other items same as 1,000-Foot Vessels)				
Subtotal, Structure				33,600,000
TOTAL, 1,200-Foot Vessels				$39,000,000

SUMMARY - ERIE AVENUE HIGH LEVEL BRIDGE

The proposed high level bridge replacement for the existing Erie Avenue Bridge is a three-span continuous through truss with the main or center span bridging the river as shown on Plate 4-1. Approach spans are deck girder with short embankment sections at each end. The main span is 700 feet long for the 1,000-foot vessels and 800 feet long for the 1,200-foot vessels.

The structure would begin at grade at the intersection of Erie and Oberlin Avenues, and would be on a new leeway alignment passing about 200 feet toward the lake from the new City Hall. It would cross the river about 400 feet downstream from the existing Erie Avenue Bridge, and run diagonally between Lakeside and Erie to an intersection at Delaware Avenue. The total length of approach fills, approach spans and the three-span main truss would be approximately 5,000 feet in order to provide necessary vertical clearance while adhering to roadway grade criteria.

Through and cross-town traffic would move freely with fewer intersections and no stoppages for passage of river vessels. Some local traffic would be adversely affected to varying degrees depending on the relation of the points of origin and destination to the bridge access intersections.

The existing structure would remain in service until the high level bridge was open to traffic. Disruption of traffic for construction would be minimal and of short duration.

Large areas of predominantly residential land would be taken for construction and permanent easements. The structure would have a substantial visual impact, particularly for those on the land side of the structure.

The estimated cost for construction is $38 million ($39 million 1,200-foot vessels). See Table 4-1 for the cost breakdown.

RECOMMENDATION FOR ERIE AVENUE HIGH LEVEL BRIDGE

A high-level replacement structure for the existing bascule bridge should be a three-span continuous through

truss with deck girder approach spans. The new structure should be located north of the existing structure, tying into the existing streets at the intersection of Oberlin and West Erie Avenues on the west and the intersection of Delaware and East Erie Avenues on the east. See Plate 4-1.

ERIE AVENUE MOVABLE BRIDGE

EVALUATION

To achieve the desired horizontal clearances, a lift bridge replacement would be more economical than the present bascule type. Although different mechanically, a lift bridge is in the same functional structure category as a bascule or swing bridge, i.e. movable structures.

There is little or no difference in the traffic service provided by a lift bridge compared to a bascule. The longer span of the lift bridge might normally indicate a longer operating time. However, operating time, within limits, is a design dependent variable. It appears an operating time no longer than that for the existing bascule bridge would be feasible, if desired.

The illustrated location of the lift bridge immediately upstream of the present bridge (Plate 4-2) appears to provide a better alignment than a downstream location. Either location is feasible. In both cases the existing bridge could remain operational during construction. There would be brief periods of traffic interference for pavement tie-in near the end of construction.

Relatively little property would be required for construction. When the existing bridge is removed, an approximately equal area of land would be freed for development and use as would be required for the new structure.

The lift bridge was chosen because of the required span. Although not beyond the limits of a bascule or swing bridge the required spans are in excess of the usual for these types. There were also specific problems in the dimensions of the counterbalancing sections which would affect location and elevation of these other types of structures.

The lift towers would be highly visible but it is anticipated that there would be no major objection. They would be entirely within the industrial river corridor and the N&W Railroad Bridge upstream is the same type structure, establishing a precedent in the area.

In general a lift bridge replacement for the existing Erie Avenue bascule span would effect no permanent changes from existing conditions. It would be essentially a functional "replacement-in-kind."

COST ESTIMATE

TABLE 4.2 COST ESTIMATES FOR ERIE AVENUE MOVABLE BRIDGE

	Quantity	Unit	Unit Price	Cost
1,000-Foot Vessels				
Structure:				
Superstructure	66,200	Sq.Ft.	$175	$11,600,000
Substructure	66,200	Sq.Ft.	25	1,650,000
Remove Existing Structure	--	L.S.	--	3,500,000
Maintenance and Protection of Traffic	--	L.S.	--	100,000
Approach Roadways	4,400	S.Y.	80	350,000
Subtotal, Structure				17,200,000

Land Costs: Right of Way				1,500,000
Track Relocations				60,000
Subtotal, Land				1,560,000
Utility Costs				250,000
Total, 1,000-Foot Vessels				$19,000,000
1,200-Foot Vessels				
Superstructure	66,200	Sq.Ft.	$205	$13,600,000
(All other items the same as the 1,000-Foot Vessels)				
Subtotal, Structure				$19,200,000
TOTAL, 1,200-Foot Vessels				$21,000,000

Note: Operating costs assumed approximately equal to present bascule bridge and no adjustment added.

SUMMARY

The lift bridge replacement for the present bascule structure would require a 370- or 470-foot span for the 1,000- or 1,200-foot vessels, respectively. Approach spans would be deck girder with short embankment sections at each end as shown on Plate 4-2.

The lift bridge could be located immediately upstream or downstream of the existing bridge.

The lift bridge would have essentially identical functional characteristics and effects on traffic and land use as the existing structure. The principal permanent impact would be the presence of the towers, the top of which would be in the order of 200 feet above mean low water.

The estimated construction cost is $19 million ($21 million for the 1,200-foot vessels). See Table 4.2 for the cost breakdown.

RECOMMENDATION FOR ERIE AVENUE MOVABLE BRIDGE REPLACEMENT

Based upon the cost and the above discussion, it is concluded that the preferred movable bridge replacement for the existing Erie Avenue Bridge is a lift bridge with fill and deck girder approaches. The new structure could be located immediately adjacent to the existing structure to connect directly to the existing roadways but also allow the old structure to remain in service until the new lift bridge is opened to traffic. (See Plate 4-2.)

N&W LIFT BRIDGE

EVALUATION

The existing Norfolk & Western vertical lift railroad bridge provides an understructure clearance of 123'-8" and channel width of 205 feet. The vertical clearance is adequate for 1,000-foot vessels. However, it was found that clearance for 1,200-foot vessels would be approximately 125 feet above Low Water Datum. Accordingly, evaluation of raising the existing bridge to a 135-foot clearance capability was considered. This can be achieved by modifying the existing bridge. Major items would be: insert additional tower structural section below main counterweight sheave platform; add stiffening as required to tower members below inserted section; new section and re-arrangement of tower stairs; furnish and install new, longer main counterweight ropes, uphaul and downhaul operating ropes, auxiliary counterweight ropes, flexible cables (electrical) and cable trough. The horizontal clearance is marginal with the channel as it now

exists, as the stern of a 780-foot vessel moving upriver is still below the bridge when the bow must be turned into the next curve. Bank cutting to straighten the channel would alleviate the problem. The 205-foot horizontal clearance would be minimally adequate in a straight reach of channel for both the 1,000-foot and the 1,200-foot vessels. Further improvement of the horizontal clearance would require structure replacement using a "roll-in" structure or a new railroad alignment to minimize disruption to railroad traffic. Costs in the same order as those for the Erie Avenue Movable Bridge would be anticipated for a replacement structure.

COST ESTIMATE

No right of way, track rearrangement, roadway or other incidental work is required. The estimated cost for the structural and mechanical work is $300,000. Only the cost of structural modifications to the bridge to increase maximum lift height is included in this estimate.

21ST STREET BRIDGE

The Existing Bridge. The existing 21st Street Bridge is a six span 1,700-foot through truss with a 400-foot river crossing span. The understructure clearance, based on a Lake Erie low water datum of 568.6', is 99.6' for approximately 250 feet in the center river crossing span. Piers are twin reinforced concrete columns on piling with a reinforced concrete strut connection near the top. The five piers range in height from 43 feet to 79 feet. The roadway is 42 feet curb to curb and there is a seven-foot sidewalk on the west side. The roadway width is inadequate by today's standards. Plans were approved in 1939 from which it is concluded the structure is in the order of 37 to 39 years old.

CONSIDERATIONS FOR RAISING THE 21ST STREET BRIDGE

EVALUATION

To raise the bridge would require the construction of temporary lifting piers and devices, jacking of the bridge, extensive reconstruction or replacement of the existing piers, construction of additional piers to replace existing abutments and for additional approach spans, construction of an additional 1,000 feet more or less of structure at each end, plus roadway relocations and other incident construction and costs.

The total cost of raising the bridge including the new approach work would be at least one half of the cost of a complete new structure.

The useful service life of a bridge is dependent on many variables. Principal items are design assumptions and concepts, materials used, construction quality control, level of maintenance and service conditions. Without an in-depth inspection it is not possible to make a conclusive evaluation of the probable future performance and requirements of this structure. However, based on experience in existing structure inspection and evaluation, it is probable that this structure would have some problems and be at least at, if not beyond, the mid-point of useful service. A major rehabilitation could rejuvenate the structure to some degree, but would substantially increase costs.

To raise the bridge would require that it be out of service for an extended period. It is estimated that this would be for at least two construction seasons. A complete new structure could be put in service with only minor restrictions on the continued use of the existing bridge during construction.

Raising of the existing bridge would probably require the lowest initial expenditure to obtain the desired clearance. However, if consideration is given to projected service life and user benefit, the raising of the structure would not be a prudent investment in comparison to a new structure.

Accordingly, this scheme has not been developed in detail. Instead, further evaluation and related discussion focuses on replacement of the 21st Street Bridge as shown on Plate 4-3.

Location. New structure alignments both upstream and downstream of the present structure were developed. With slight exception to the grade criteria, a line on the upstream of the existing structure can utilize the existing railroad underpass, which minimizes property taking and costs on the south end. However this alignment also requires relocation of a major electric transmission line and an oil tank farm on the north end. The alignment downstream fully meets alignment criteria although the curves on the bridge are not particularly desirable, and the approach structures are longer. There would consequently be more property taking, most of which would be commercial area. This alignment also crosses over the railroad and requires elimination of the present Elyria-21st Street intersection. Each alignment has advantages and disadvantages that are different. These are difficult to quantify and compare at this level. The downstream alignment was selected because the grade is better and it eliminates the potential problems inherent in relocating facilities such as the transmission line and tank farm. The rearrangement of traffic patterns in the Elyria Avenue intersection could be worked out to be a benefit rather than a liability.

Structure Type. The three-span continuous through truss main section is usually the most economical type when understructure clearance is critical. Similiarly, deck girder approach spans are usually most economical except possibly for the railroad crossing which might be a short through truss or girder section. With the exception of the railroad crossing, there appear to be no restraints on using a uniform economical pier spacing. A 600-foot main span length is necessary to keep all piers out of the river, safeguarding both vessels and the bridge. The four 12-foot lanes, medial reservation, medial barrier and eight-foot shoulders are accepted current practice. The added width of the median reservation and shoulders is particularly desirable because of the curves in the structure. A six-foot sidewalk was included on one side only as it is anticipated that pedestrian traffic would be minimal.

Traffic. Both cross-town and local traffic should move as well as with the present structure with the additional width and clearances offsetting the longer grades. If the street rearrangements in the Elyria-Broadway Avenue area are properly developed some incidental improvement could accrue.

Other Impacts. Some permanent loss of commercial sites will occur at both ends of the new extended structure. However, the land which would be under most of the bridge is vacant and would be replaced by land made available when the existing structure is removed. Except at the ends of the structure, density and land use appear to be such that there would be little opposition to the structure. The existing structure has established a precedent acceptance of a major structure in this vicinity.

COST ESTIMATE

TABLE 4.3 COST ESTIMATE FOR 21ST STREET BRIDGE

	Quantity	Unit	Unit Price	Cost
1,000-Foot and 1,200-Foot Vessels				
Structure:				
Superstructure	324,000	Sq.Ft.	$85	$27,540,000
Substructure	324,000	Sq.Ft.	20	6,480,000
Remove Existing Structure	--	L.S.	--	2,500,000
Maintenance and Protection of Traffic	--	L.S.	--	100,000
Approach Roadways	9,600	S.Y.	80	770,000
Street Rearrangement	5,000	S.Y.	80	400,000
Subtotal, Structure				37,800,000
Land				1,600,000
TOTAL				$39,400,000

SUMMARY

The existing 21st Street Bridge has an understructure clearance of 99.6 feet and a navigable channel width of 250 feet. Both dimensions are constraints to navigation by 1,000-foot and 1,200-foot vessels. The proposed high level bridge replacement for the existing 21st Street Bridge is a 3-span continuous through truss with a center or river span of 600 feet. Approach spans are deck girder with short embankment sections at each end. The only differences between the structures for the 1,000- and 1,200-foot vessel would be pier height and percent of grade.

Raising the existing structure to obtain the required clearances was considered. This would be possible but does not appear a prudent choice, primarily because of the age of the existing structure (constructed about 1940). As shown on Plate 4-3, the proposed structure begins on the line of

21st Street between Broadway and Elyria, crosses above the railroad, turning to the west or downstream of the present structure, which it parallels to the opposite bank. curves to the east rejoining the present 21st Street alignment approximately 400 feet south of the 21st Street intersection with Colorado Avenue.

With the proposed structure, both local and through traffic could move more freely due to the elimination of the complex 21st Street-Elyria Avenue intersection and street relocations.

The existing structure would be kept in service until the new structure was open to traffic by staged construction and temporary access roads.

Some predominently commercial areas would be permanently taken with no equivalent return upon removal of the existing structure. This is due to the greater length of the new structure intruding into areas at both ends not affected by the existing structure.

For both the 1,000- and 1,200-foot vessel options, the estimated cost of construction would be $39.4 million (see Table 4.3). At this level of development the cost variation between the 1,000- and 1,200-foot vessel structures does not change the estimate. With the same span and total lengths, the pier height differences have a relatively small effect on total cost.

RECOMMENDATION

The replacement for the present 21st Street Bridge should be a full four-lane structure from the vicinity of the intersection of 21st and Broadway to the vicinity of the

intersection of 21st and Colorado. The main river crossing span should be the center span of a three-span continuous through truss with approach spans of deck girder design.

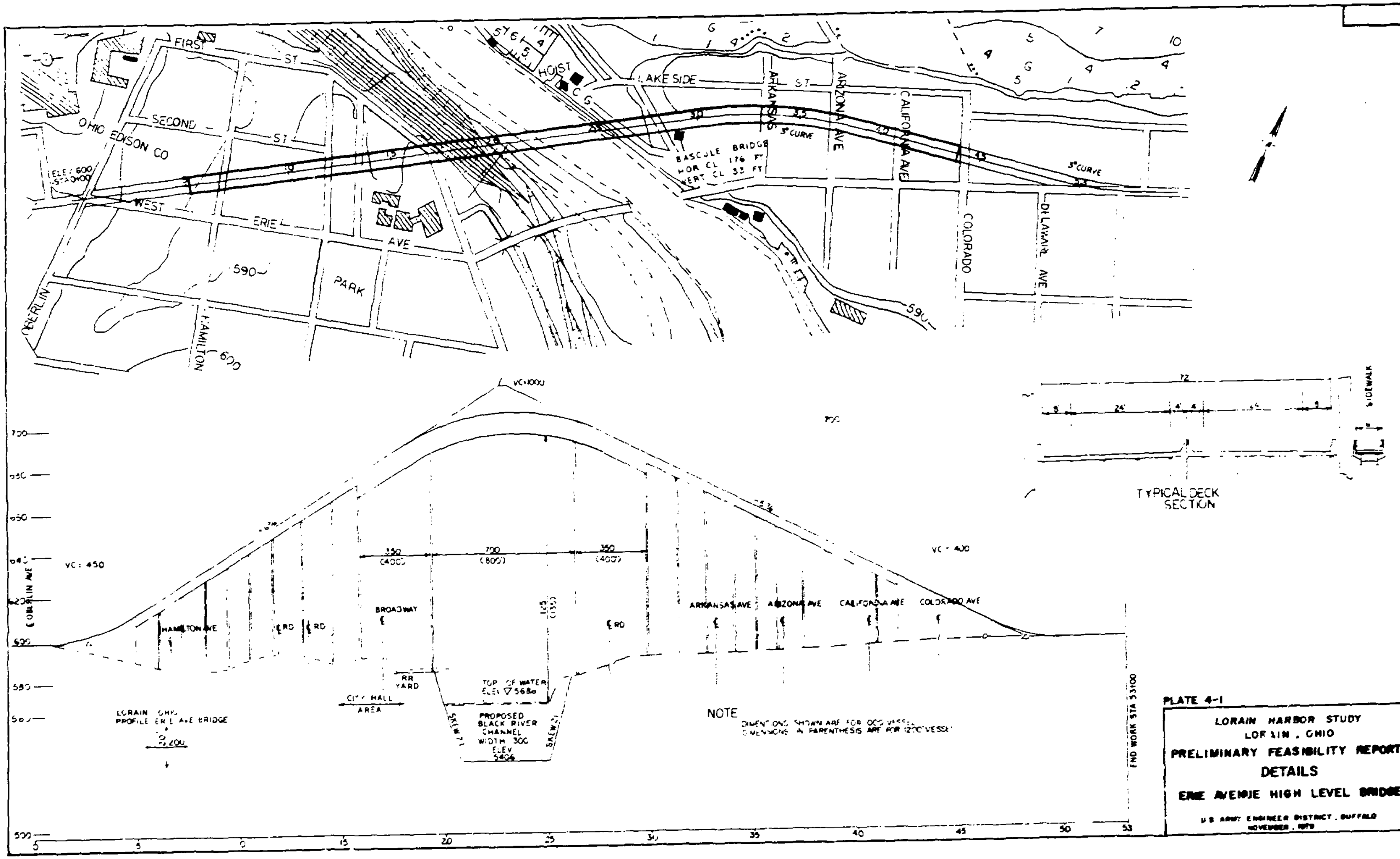
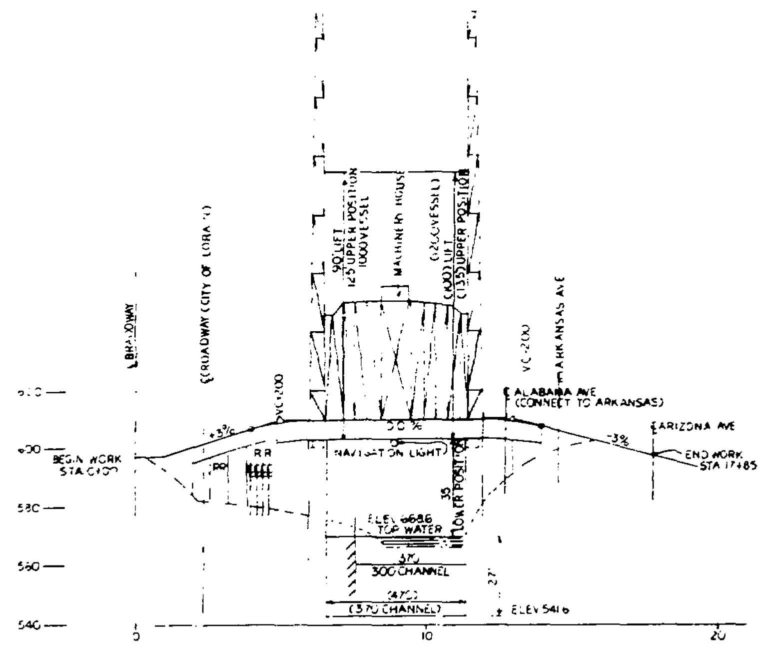
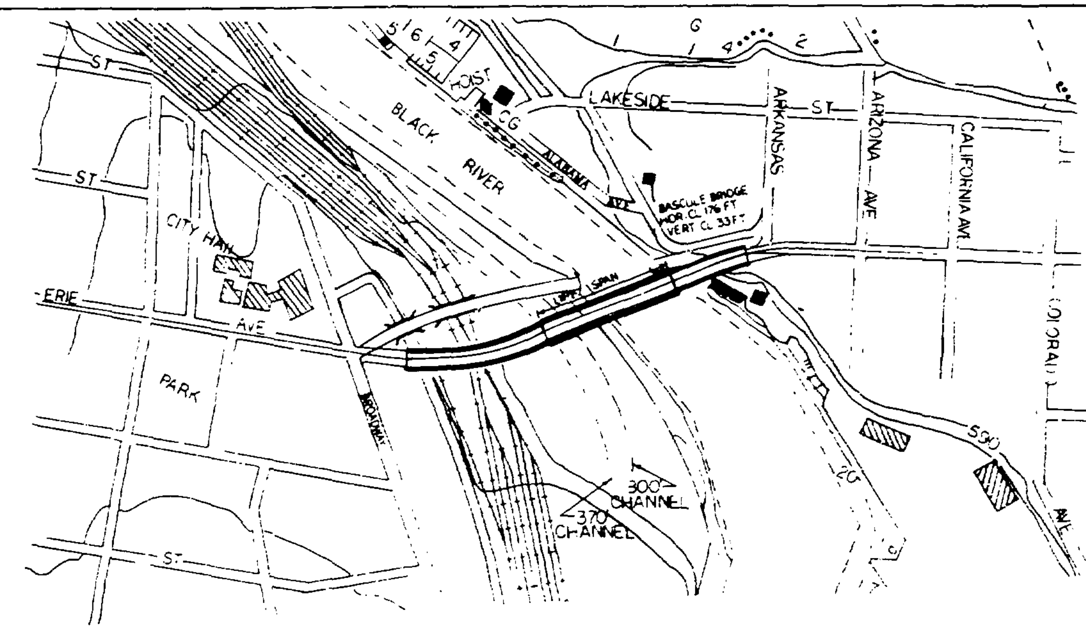


PLATE 4-1

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
DETAILS
ERIE AVENUE HIGH LEVEL BRIDGE
U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979





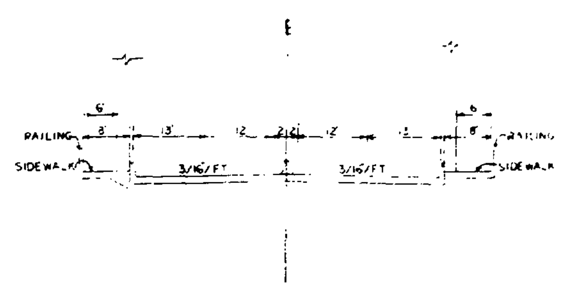


PLATE 4-2

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
DETAILS
ERIE AVENUE LIFT BRIDGE
U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979

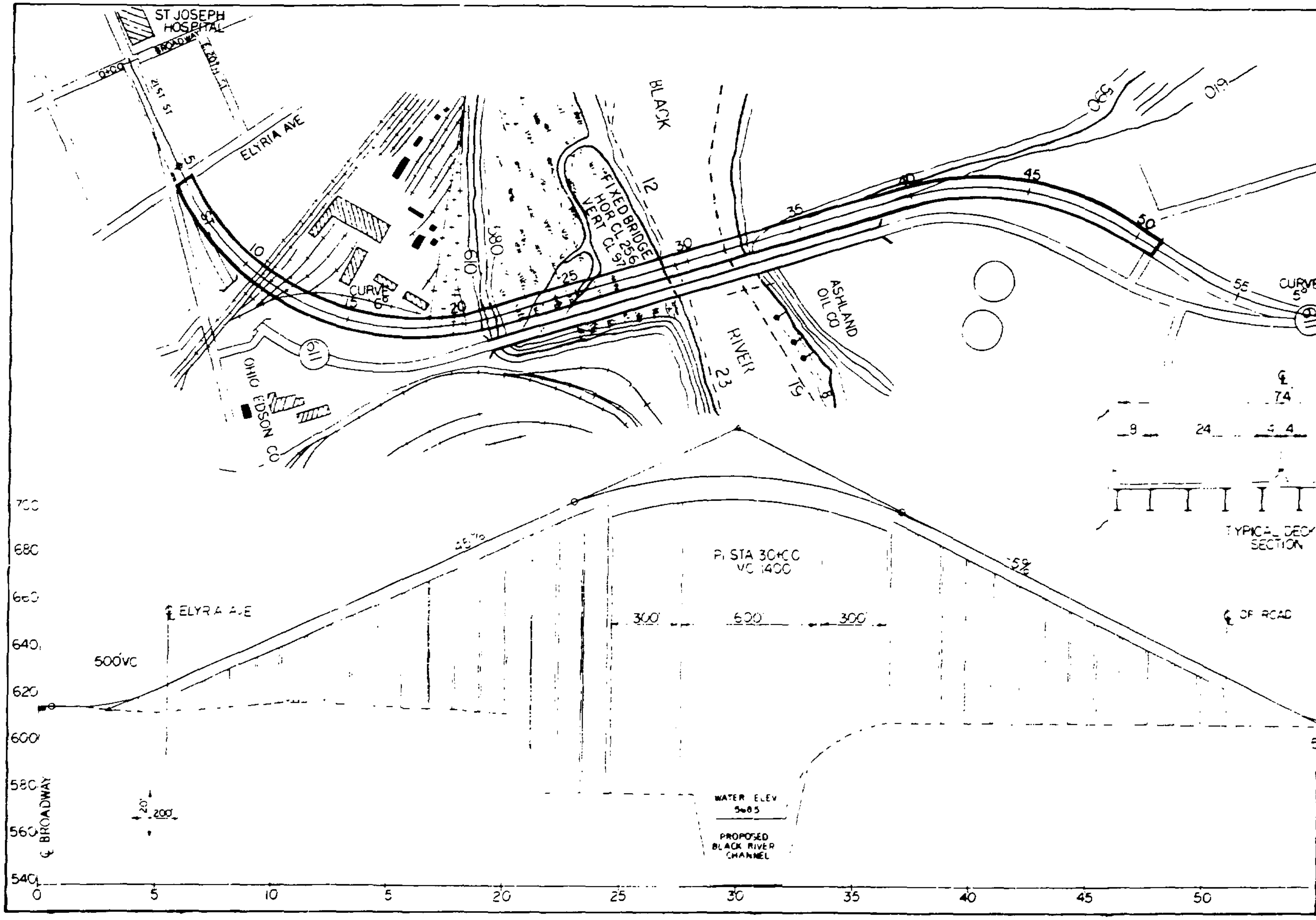


PLATE 4-3

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
DETAILS
21st STREET HIGH LEVEL BRIDGE

U.S. ARMY ENGINEER DISTRICT BUFFALO
NOVEMBER, 1979

SECTION 5 - TUNNEL (ERIE AVENUE)

GENERAL

Scope. A subaqueous tunnel was considered as a replacement for the existing Erie Avenue bascule bridge over the Black River in order to provide clearances required for 1,000-foot and 1,200-foot vessels. The differences in the requirements for the 1,000-foot and 1,200-foot vessels make no significant differences when location and alignment criteria are considered, and only one concept was developed.

Criteria. The criteria used to define the study structure can be identified in 5 categories: a) location; b) alignment and dimensions; c) geology; d) tunnel environment; and e) maintenance and operating policy.

(a) Location: Location criteria are not absolutes but goals that are traded off to obtain the best balance. The goals are:

(1) To provide maximum accessibility and capacity.

(2) To minimize permanent disruption of property and established activities.

(3) To maintain acceptable traffic patterns and flow during construction.

(b) Alignment and Dimensions: Ohio Department of Transportation Classification UA (Principal Urban Arterial) was used with additions from AASHTO "Policy on Design of Urban Highways and Arterial Streets" for tunnel requirements.

The criteria are:

(1) Design Speed: 50 MPH

(2) Curves: 7°-30' max.; 3° desirable

(3) Grade: 6% max.; 0.24% min.

(4) Stopping Sight Distance: 350' min.; 450' desirable

(5) Width (2 lane): 30' min.; 44' desirable

(6) Sidewalk: 2-1/2' min.

(7) Wall Clearance: 1-1/2' min.

(c) Geology: Subsurface conditions are not usually called "criteria." However in tunneling, geology is certainly one of, if not the principal basis for decisions in regard to structure type and design. The principal source for geologic information was the 1938 test boring data for the existing Erie Avenue bascule bridge.

The present Black River lies at the northern side of what appears to have been a wider or previous channel. The underlying competent material is a medium hard black shale. This is overlain with weathered shale and clay. Mixtures of sand, silt, clay and vegetation extend to the surface and are probably remnants of early river bed and terrace deposits. The top of competent shale is at about elevation 500 under the level area south of the

river and rises to about 550 north of the river and south adjacent to Broadway Avenue.

(d) Tunnel Environment: The two major items to be considered are air quality and lighting.

(1) Air Quality Control: Carbon monoxide 125 p.p.m. maximum hourly average.

(2) Lighting Levels (Approximate, maintained):

a. Day: Intensive zone 100 foot-candles (f.c.), normal zone 8 f.c.

b. Night: Tunnel 8 f.c., approaches 3 f.c.

Noise is usually considered only for the tunnel ventilation plant. Exposure time in the tunnel is limited and both vehicular noise generation and protection are controlled by receptor individuals.

(e) Maintenance and Operating Policy: The following major assumptions were made:

(1) Tunnel would be manned rather than automated;

(2) Emergency services would be provided;

(3) Routine maintenance would be provided by tunnel staff.

EVALUATION

Location. Crossing alignments both up and downstream from the existing Erie Avenue Bridge were considered. In

general, all alignments not on Erie Avenue would require more temporary and permanent disruption of existing commercial and industrial activity on the south side of the river without any compensating advantages. There are additional disadvantages in moving too far either way from the existing structure. Alignments not on Erie Avenue generally require increases in the length of the expensive subaqueous portion of the tunnel. There would also be additional work and costs in connecting the tunnel back to the main traffic artery.

A location immediately upstream was selected to utilize as much existing right of way as possible and to minimize any possible effect on the adjacent City Hall. A location immediately downstream of the existing structure was a close second. With more information and development than is possible or practical for this study, it could become an equal or preferable location. This would have no significant effect at this level on the comparative assessment of a tunnel as an alternate to the existing structure.

Locations requiring shutdown of the existing bridge prior to, or early in, construction were not considered. A two- to four-year period with no crossing facility in this vicinity would not be tolerable. If this were not the case, it would raise the question of the need for any crossing facility for Erie Avenue.

Structure Type and Design. In tunnel design, basic structural selections and decisions are determined by two major considerations -- service requirements and site geology.

Service requirements include the dimensional and alignment minima and maxima noted previously under "Alignment and Dimensions." Ventilation system type and requirements

as well as operating assumptions also affect size and detail design.

Site geology determines the types of construction and consequent structures that are feasible.

The dimensional, ventilation and operating criteria dictate a rectangular tunnel section in the order of 75 to 95 feet in width and 23 feet to 30 feet in depth, two 40'± circular sections or two 38'± wide by 32'± high horseshoe sections. A supply air duct is required for the semi-transverse ventilation system. This type system is required rather than a longitudinal system without ducts because of the relatively steep grades and the vertical alignment of the tunnel. The near minimum width for a two-lane tunnel was used because it was assumed the tunnel would be manned and emergency services provided.

The basic types of construction considered were: conventional or machine driven twin tunnels in competent material, twin circular tunnels driven by a shield under air; a "sunken tube" tunnel; cut-and-cover tunnel and soft ground tunneling.

The twin tunnels in competent material appeared least desirable. In addition to some question as to the competence of shale in a subaqueous tunnel the top of competent material is about elevation 500. This would require a roadway grade low point about elevation 455 and a 5,000-foot tunnel with at-grade access points in the order of 6,500 feet apart. Although this method is least expensive per linear foot of tunnel, the increased length and increased ventilation, building and electrical construction costs would make this method at least as expensive as the other methods. In addition there would be the comparatively low local user

benefit due to the wide separation of the points of access and much higher operation and maintenance costs.

The remaining methods would not be appropriate for the full length of tunnel. The soft ground and cut-and-cover would be feasible for approaches to the river and the shield or sunken tube feasible under the river. The shield could be used for the approaches to the river but is not necessary or economically competitive.

The shield does not appear practical for the total tunnel or the subaqueous section. The presence of vegetation, clay, soft black shale and debris in at least the top of the face south of and under the river could require compressed air or bentonite slurry to prevent flooding. The consequent difficulty and cost of plant, equipment and work force mobilization and operation makes this method questionable for a tunnel of this length. The requisite two tube circular configuration would also require a lower and consequently longer tunnel which would affect both construction and operating cost.

The sunken tube method shares the problem of the high cost of mobilization of plant equipment and work force for a short tunnel. This method requires onshore construction of the tunnel in segments with temporary bulkheads. The segments are launched, floated to the site, sunken, installed in previously dug trenches, connected, dewatered, and the bulkheads removed. However, the geology, if not ideal, is suitable. There might be some trench side slope stability problems on the southside of the river and some tough excavating toward the north but these normally are surmountable problems. The currents in the river are slow enough and river traffic can be controlled. The required skilled workforce would be available from established local shipbuilding, construction and industrial activities.

The selection of cut-and-cover rather than soft ground tunneling for the approach tunnels was primarily economic. Two soft ground tunnels separated by about one diameter and the attendant costs together with relatively few surface structures made cut-and-cover more economical.

Miscellaneous Concepts. Fan house, fan motor and drive, electric power distribution and lighting concepts were developed to the level necessary to estimate construction and operation costs. A maintenance and operating staff and equipment were projected to develop annual and reserve replacement fund costs.

These concepts and projections were based on usual and ordinary practice for modern urban tunnels in the Northeast United States, and therefore could be expected for this tunnel.

General: A tunnel replacement for the existing Erie Avenue bascule bridge would have the following comparative advantages and disadvantages:

(a) Interruption of traffic for the passage of vessels on the river would be eliminated.

(b) The tunnel would cause inconvenience during construction but would, upon completion, be mostly invisible with minimal permanent impact on surface activities and facilities.

(c) Through or cross-town traffic would move more freely. Some local trips would become longer. For example, the present half-mile trip from Erie and Broadway to Erie and Colorado would be well over a mile.

(d) Construction costs for a highway tunnel are higher per foot than all highway structures.

(e) Tunnels require continuous operational and maintenance activities and costs not usual for highway structures.

COST ESTIMATES

TABLE 5.1 COST ESTIMATES FOR ERIE AVENUE TUNNEL

Item	Cost	
Depressed Approaches	$ 2,500,000	
Cut-and-Cover Tunnel 1,910 L.F. @ $10,500/L.F.	20,055,000	
Sunken Tube Tunnel 1,000 L.F. @ $18,000/L.F.	18,000,000	
Fan House, Shaft, Wash Water Treatment Plant	6,000,000	
Electrical: Tunnel Lighting, Fan and Fan House Power, Control and Communication Systems	4,375,000	
Ventilation Equipment: Fans, Motors, Drives and Motor Starters	1,170,000	
Maintenance and Protection of Traffic During Construction	400,000	
Track Support and Relocation	200,000	
Street Rearrangement	1,100,000	
Existing Bridge Removal	3,500,000	
Subtotal: Structure Construction Cost		$53,800,000
Utility Maintenance, Support, Relocation Electric and Telephone	$ 540,000	
Water, Sanitary and Storm Sewers	710,000	
Subtotal: Utilities		$ 1,250,000
Land: Right of Way Costs		3,000,000
Tunnel Total		$58,000,000

TABLE 5.2 OPERATION AND MAINTENANCE COST ESTIMATES

Item	Cost	
Annual Operation and Maintenance		
Salary and Burden: 1 Superintendent, 1 Foreman, 2 Electricians, 2 Maintainers, 10 Operators, 1 Clerk	$287,000	
Materials, Supplies and Services: Water, Sewage, Telephone, Fuel, Office Supplies, Detergent, Brushes, Lamps, Vehicle Maintenance, Small Tools	24,000	
Electric Power: 4,500,000 KWH @ $0.05	225,000	
Subtotal: Annual Maintenance and Operation		$ 536,000
Periodic Costs		
Initial Equipment: Crash Truck, Pickup Trucks, Lamp Truck, Wash Truck, Flushing Truck, Office Furniture and Equipment, Tools	250,000	
Average Annual Maintenance Equipment Replacement	24,000	
25th Year Renovation		
Ventilation Equipment: Replace Motors, Starters, Bearings, Drives, Clean and Paint	375,000	
Electrical: New Lighting Fixtures, Panels, Wiring	1,450,000	

Clean-up, Painting, Tile Replacement	175,000
Subtotal: 25th Year Renovation	$ 2,000,000

Notes:

1. All costs including 25th Year rehabilitation are 1979 costs.

2. Construction easement, work area costs included in land costs.

3. Average annual equipment replacement based on 5- to 10-year frequency for specific major equipment items.

SUMMARY

A tunnel replacement for the existing Erie Avenue Bridge would have four 13' traffic lanes, two 2-1/2' emergency sidewalks and a 6' pedestrian passageway. Lighting would be by continuous fluorescent fixtures on each wall of the two traffic ducts. Semi-transverse ventilation would have separate supply air ducts but use the traffic ducts to exhaust vitiated air.

Total tunnel length would be approximately 3,000' with 1,000' constructed by the sunken tube method and 2,000' by cut-and-cover methods. Grades near the 6% maximum would be used to minimize tunnel length. A building to house ventilation, operating and maintenance equipment located immediately south of the river would be connected to the tunnel by a vertical ventilation and access shaft.

The tunnel portals would be aligned with Erie Avenue, with grade intersection at Hamilton Street to the south and Delaware Street to the north. Widening of Erie Avenue e depressed approach and portal areas would be required to provide parallel local traffic lanes. Cross-town traffic

would travel substantially the same distance with fewer intersections. Local traffic would be adversely affected in varying degrees depending on the relation of the points of origin and destination to the tunnel entrances. Interruption of traffic for the passage of vessels on the river would be eliminated.

The existing bascule structure would remain in service until the tunnel was open to traffic. Cut and cover construction along Erie Avenue would require considerable long-term rerouting of traffic to other streets and a limited amount of temporary road construction at the approaches to the present bridge.

Unit costs for tunnel construction would be much higher than normal. This is due to the basic costs of mobilization of plant, equipment and work force for two types of tunnel construction for a limited amount of work.

The estimated cost of construction is $58 million (Table 5.1). In addition there are continuing maintenance and operation costs for a tunnel that would not apply for fixed bridges (see Table 5.2).

RECOMMENDATION

A tunnel replacement for the Erie Avenue bascule bridge over the Black River should be approximately 3,000 feet long with 1,000 feet under the river constructed as a sunken tube tunnel and the land tunnels constructed by the cut-and-cover method. The tunnel and depressed approaches should be located on the present Erie Avenue alignment as much as possible except at the river crossing where it would be located upstream of the existing bridge. The tunnel should have four 13' traffic lanes, two 2-1/2' safety walks, one 6'

pedestrian passageway, semi-transverse ventilation and continuous lighting. The tunnel should be manned 24 hours a day and provision should be made in the ventilation building for control, maintenance and emergency equipment. All systems normal and usual to a modern urban tunnel such as communications and contaminent sampling and recording, should be provided.

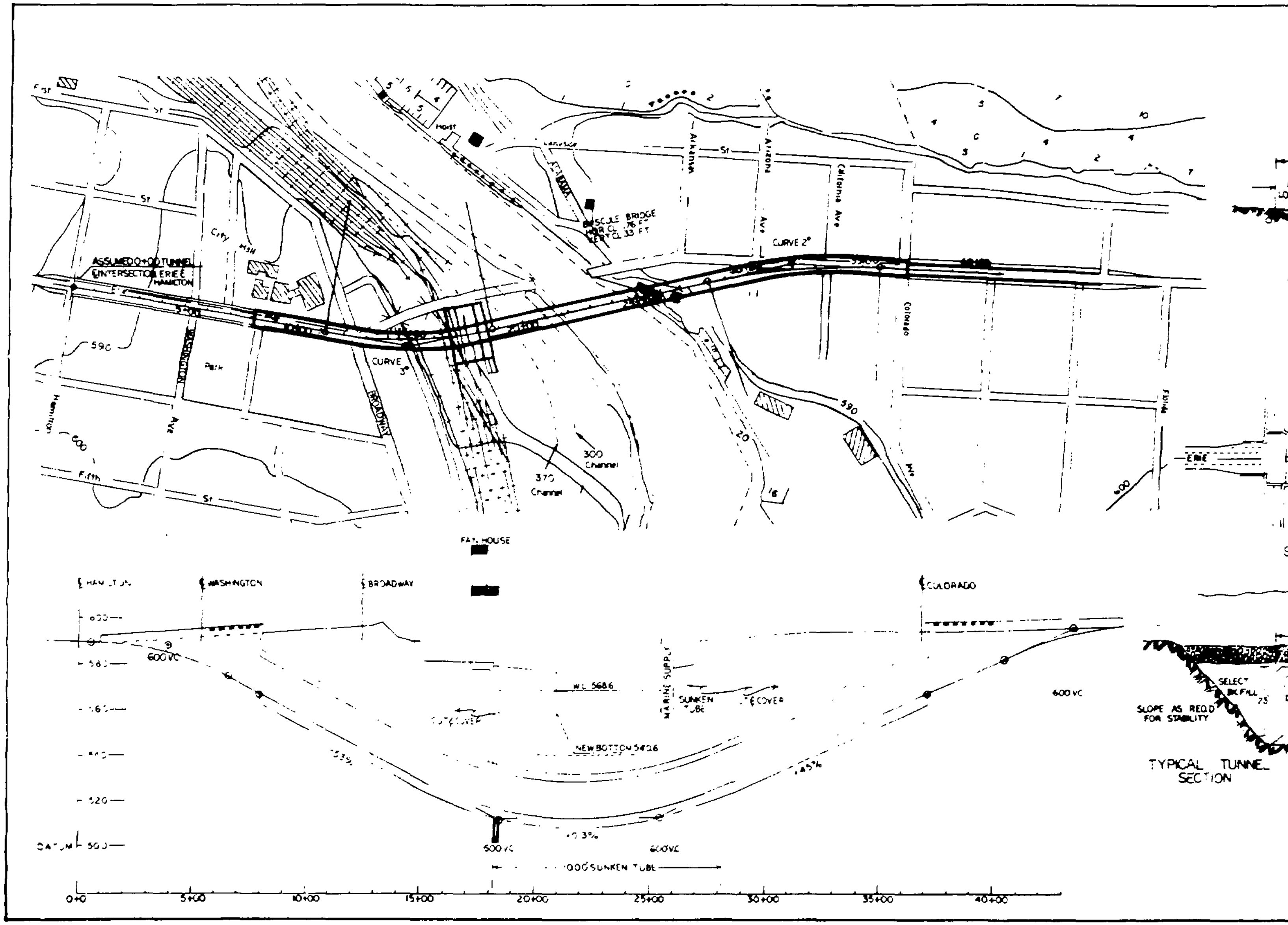


PLATE 5-1

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
DETAILS
ERIE AVENUE TUNNEL

U.S. ARMY ENGINEER DISTRICT, BUFFALO
[illegible], 1979

SECTION 6 - TRANSSHIPMENT FACILITIES

GENERAL

Scope. As an alternative to direct shipment of iron ore pellets to the U.S. Steel plant on the Black River by 1,000- or 1,200-foot vessels, transshipment to the plant from downriver sites has also been evaluated for this study. Two locations were considered for constructing transshipment facilities. One location would be on the east bank of the Black River just downstream from the 21st Street Bridge (see Plates 7-5 through 7-8 of Section 7) and the other location would be at the Lakefront where the Black River empties into Lake Erie (Plates 7-9 through 7-16). A transshipment facility would provide adequate berthing for the vessel sizes under study, temporary onshore storage of material in open stockpiles and a transportation system for moving the material upriver. The schemes for transporting cargo upriver consider conveyor transshipment, special purpose vessel transshipment, truck transshipment and rail transshipment. In all cases, it has been assumed that the 1,000- and 1,200-foot vessels would be equipped with self-unloaders.

Criteria. The transshipment alternatives have been developed on the basis of a 50-year project life. U.S. Steel is planning a major expansion at the Lorain plant and the annual quantity of iron ore pellets delivered to Lorain will increase significantly during the 50-year study period. Presently, 2,800,000 tons of iron ore is shipped to U.S. Steel's Lorain-Cuyahoga Works. U.S. Steel's twenty-year projection of ore consumption is as follows:

Year	Tons
1985	3,500,000
1995	5,000,000
2000	7,000,000

Expanding U.S. Steel's projections to the 50th year, 2030, it has been estimated that the annual shipments will be 8,000,000 tons. All of the conceptual designs and construction cost estimates for each of the alternatives have been developed on this projected future consumption of 8,000,000 tons. The base year or project year 1 tonnage selected for this study was 5,000,000 tons. The annual operation and maintenance costs have been calculated for handling both the base year tonnage as well as the future or 50-year tonnage, all in February 1979 dollars.

The general layout of a transshipment facility at Lorain would be representative of a typical onshore dry bulk cargo terminal and very similar in plan to transshipment schemes presently under consideration by Republic Steel and United States Steel.

Function. All of the transshipment facilities would function in a similar manner except for the particular method employed to transport the iron ore pellets upriver to the U.S. Steel plant. A dockside hopper would receive the cargo discharged from the self-unloading booms of the 1,000- or 1,200-foot vessels. The hopper would then direct the material flow onto a 42" belt conveyor with a belt speed of 650 feet per minute that would move the iron ore pellets towards a transfer station. The transfer station would serve as a control point directing all or a portion of the material to storage or on to the particular transportation mode selected for moving the pellets to their final destination.

When directed to storage, the iron ore pellets would be placed in open stockpiles by a specially designed rail mounted, traveling-luffing boom bucket wheel stacker-reclaimer. The stacker-reclaimer would also be capable of

recovering the pellets from storage, but complete or 100% recovery from the stockpiles would require two crawler tractors to push the iron ore pellets to within reach of the boom of the stacker-reclaimer.

The storage area would be comprised of four separate stockpiles. The stockpiles would be isolated from one another by open land area or by bin walls if space limitations would so dictate in order to maintain segregation of different grades of pellets. It is estimated that four stockpiles would be required at a transshipment facility in Lorain based on the projected tonnage (beginning with the base year tonnage of 5 million tons per year through the fiftieth year tonnage estimated at 8 million tons per year) and vessel frequency in port. Each stockpile would have a capacity equivalent to the cargo delivered by one vessel; 60,000 long tons if a 1,000 footer and 72,000 long tons if a 1,200 footer.

TRANSSHIPMENT - EAST BANK OF THE BLACK RIVER BELOW 21ST STREET

EVALUATION

A transshipment facility located on the east bank of the Black River below 21st Street would employ a conveyor system to complete the transfer of iron ore pellets upriver (see Plates 7-5 through 7-8). A bridge, spanning the Black River, would be required to convey the pellets to U.S. Steel's Lorain-Cuyahoga Works located on the west bank. The total length of belt conveyor required would be approximately 4,000 lineal feet. The east bank location of the facility was selected in lieu of the west bank because a west bank site would displace an existing wetland downstream of 21st Street. In recent discussions with Buffalo District personnel,

the U.S. Fish and Wildlife Service has indicated that the wetland habitat is not as productive as originally contemplated and filling of the wetland probably would be permissible. Therefore, if this stage of the study indicates that further consideration of transshipment from the 21st Street locations is warranted, relocation of the transshipment facility to the west bank will be considered.

The conceptual layout of this transshipment facility proposes locating two of the four stockpiles next to the wharf which would permit direct vessel-to-stockpile unloading. This feature would permit 1,000- and 1,200-foot vessels to offload their cargo when the conveyor system would be down for repair or maintenance.

COST ESTIMATES

Cost estimates for a transshipment facility located below 21st Street Bridge are listed in Table 6.1. Each alternative has two options: Option 1 - 1,000-foot vessels and Option 2 - 1,200-foot vessels. The cost estimates are divided into five areas: Site Development, Wharf Construction, Material Handling System, Conveyors and Utilities. Site development includes earthwork, site preparation and construction of an access road. The material handling system includes the dock hopper, stacker-reclaimer, crawler tractors and an office building/control center. Utilities include storm and sanitary sewers, waterlines and electrical service. For all cost estimates, an allowance of $250,000 has been made to cover the cost of providing these utilities at each transshipment facility. As is the case for all associated transshipment costs in this section, detailed quantities and costs are provided as Attachment 1 to this Appendix.

TABLE 6.1 - NAVIGATION CONCEPT - TRANSSHIPMENT: EAST BANK OF THE BLACK RIVER BELOW 21ST STREET

Option 1 - 1,000-Foot Vessels

Item		Costs
Site Development	$ 956,850	
Wharf Construction	1,510,800	
Material Handling System	2,871,000	
Conveyors	9,031,500	
Conveyor Bridge	1,513,950	
Subtotal, Conveyor System		$15,884,100
		Say $15.9 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		$16.1 million

Estimated Annual Operation and Maintenance Costs

5 MTPY*	Power	$ 730,000	
	Repair and Maintenance	465,000	
	Labor	790,000	
			$ 1,985,000
			$0.40/ton
8 MTPY	Power	$ 1,015,000	
	Repair and Maintenance	505,000	
	Labor	900,000	
			$ 2,420,000
			$0.30/ton

* MTPY - Million Tons Per Year

Option 2 - 1,200-Foot Vessels

Item		Costs
Site Development	$ 667,600	
Wharf Construction	1,871,375	
Material Handling System	3,185,250	
Conveyors	9,369,000	
Conveyor Bridge	1,613,950	
Subtotal, Conveyor System		$16,707,175
		Say $16.7 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $17 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 740,000	
	Repair and Maintenance	470,000	
	Labor	790,000	
			$ 2,000,000
			$0.40/ton
8 MTPY	Power	$ 1,025,000	
	Repair and Maintenance	510,000	
	Labor	900,000	
			$ 2,435,000
			$0.30/ton

RECOMMENDATIONS

The evaluation of a transshipment facility below 21st Street considered development on the east bank only. The west bank was not considered because it is presently classified as a wetland by the U.S. Fish and Wildlife Service. Fish and Wildlife is presently conducting a "Four Season Study" at Lorain Harbor. Should the wetland classification of this area be changed, consideration should be given to developing a transshipment facility on the west bank. The primary advantage of the west bank location would be eliminating the need for the conveyor bridge over the Black River and also reducing the length of conveyor required at an estimated savings of approximately $3,750,000.

LAKEFRONT TRANSSHIPMENT - INTRODUCTION

A conceptual Lakefront transshipment facility was developed around Republic Steel Corporation's proposed Taconite Terminal that is presently under construction in Lorain Harbor at the mouth of the Black River. Republic's facility is shown graphically on the drawings for the Lakefront transshipment alternatives with heavy black dashed lines (Plates 7-9 through 7-16). The development of Republic

Steel's facility influenced the decision to propose utilizing an existing coal slip as the berthing facility for 1,000- and 1,200-foot vessels that would service the U.S. Steel plant upriver. The coal slip is located between the east and west piers of the terminal formerly operated by the Toledo, Lorain and Fairport Company. The east pier, selected as the wharf for the proposed transshipment facility, would require renovation and structural modifications to render it suitable for a docking facility. The coal slip would also require dredging to provide a suitable draft for the vessels.

A conveyor system, fed by a dock hopper erected on the east pier, would receive the shipments of iron ore pellets and direct the material flow to a transfer station for subsequent routing to storage or to the transportation mode selected for transporting the iron ore upriver. Approximately 1,500 lineal feet of tunnel construction would be required to permit the conveyor, running between the dock hopper and the transfer station, to pass beneath Republic's pellet storage piles and an additional 30 lineal feet of tunnel would be necessary to effect a below grade rail crossing. These features would be common to all Lakefront transshipment schemes.

LAKEFRONT TRANSSHIPMENT WITH UPRIVER CONVEYOR SYSTEM

EVALUATION

The upriver conveyor system would begin at the first transfer station located beyond the stockpiles as shown on Plate 7-9. The conveyor system would meander upriver, pass beneath the approach ramp to the 21st Street Bridge and terminate at U.S. Steel. The conveyor would require elevated structures to bridge across East 9th Street and to bridge over the N&W Railroad tracks. At ground level, the conveyor

would be enclosed by a prefabricated metal building for safety and to diminish noise pollution. Dust collection systems would be provided at each transfer point.

Evaluating the upriver conveyor system based on the fiftieth year projected future consumption of 8,000,000 tons, approximately 6,200 horsepower would be required to drive the system which would result in an estimated power cost of approximately 1.2 million dollars per year. This estimation is based on the conveyor system operating 16 hours a day, 7 days a week for the duration of the shipping season.

COST ESTIMATES

Cost estimates for Lakefront transshipment with an upriver conveyor system are listed in Table 6.2. Two options exist: Option 1 - 1,000-foot vessels and Option 2 - 1,200-foot vessels. The Cost Estimates are divided into six areas: Bank Cuts and Deepening, Site Development, Wharf Construction, Material Handling System, Conveyors and Utilities. Bank cuts and deepening consists of dredging between the east and west piers of the former Toledo, Lorain and Fairport Company terminal.

TABLE 6.2 - NAVIGATION CONCEPT - LAKEFRONT TRANSSHIPMENT WITH UPRIVER CONVEYOR SYSTEM

Option 1 - 1,000-Foot Vessels

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	814,740	
Wharf Construction	126,250	
Material Handling System	2,871,000	
Conveyors	25,605,000	
Subtotal, Conveyor System		$29,416,990 Say $29.4 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say 30.2 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 1,320,000	
	Repair and Maintenance	790,000	
	Labor	840,000	
			$ 2,950,000
			$0.60/ton
8 MTPY	Power	$ 1,830,000	
	Repair and Maintenance	830,000	
	Labor	965,000	
			$3,625,000
			$0.45/ton

Option 2 - 1,200-Foot Vessels

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	843,660	
Wharf Construction	126,250	
Material Handling System	2,871,000	
Conveyors	25,942,500	
Subtotal, Conveyor System		$29,783,410 Say $29.8 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $30.6 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 1,320,000	
	Repair and Maintenance	795,000	
	Labor	840,000	
			$ 2,955,000
			$0.60/ton
8 MTPY	Power	$ 1,830,000	
	Repair and Maintenance	835,000	
	Labor	965,000	
			$3,630,000
			$0.45/ton

LAKEFRONT TRANSSHIPMENT TO SPECIAL PURPOSE VESSEL

EVALUATION

The special purpose vessel should be a highly maneuverable craft, suitable for river navigation, yet also capable of sailing the open lakes. The vessel would transport iron ore pellets from the Lakefront to U.S. Steel's docks at the three mile limit of the Black River. The vessel would be self-unloading and would carry a cargo of 22,400 tons. The special purpose vessel investigated for this study would be designed to the following specifications: 630' length, 68' beam, 40' height (deck to keel), 27.5' draft and 24,000 long tons cargo capacity. For operation on the Black River, the vessel cargo load would be limited to 20,000 long tons (22,400 short tons) to reduce the draft.

A berthing facility would be constructed for the special purpose vessel on the west bank of the Black River, just upstream from Erie Avenue. The channel would be widened in this area to permit the vessel to turn around without having

to enter the Outer Harbor. The vessel would receive its cargo from a shiploader located at the special purpose vessel wharf. The shiploader would be of the traveling loading tower type and would be capable of loading a special purpose vessel at the rate of 6,000 tons per hour. Conveyors would be utilized to move material to the shiploader. The stockpiles would also be located upstream from Erie Avenue and west of the special purpose berthing facility. Placing the stockpiles in this location would require the removal of 6,500 lineal feet of railroad trackage.

Evaluating the system based on the fiftieth year projected future consumption of 8,000,000 tons, one special purpose vessel, operating 16 hours per day, 6 days a week for the duration of the shipping season with an estimated cycle time of 8 hours would be capable of delivering a maximum 8.3 million tons of iron ore to U.S. Steel. This is 0.3 million tons more than is required and yields a factor of safety of only 1.04.

COST ESTIMATES

Cost estimates for Lakefront transshipment to a special purpose vessel are listed in Table 6.3 below. Each alternative has two options: Option 1 for 1,000-foot vessels and Option 2 for 1,200-foot vessels. Each cost estimate is divided into seven areas: Bank Cuts and Deepening, Site Development, Wharf Construction, Material Handling System, Conveyors, Special Purpose Vessel Loading Facility, Special Purpose Vessel and Utilities. Site development includes rail removal. The shiploader is included with the material handling system costs.

TABLE 6.3 - NAVIGATION CONCEPT - LAKEFRONT TRANSSHIPMENT TO SPECIAL PURPOSE VESSEL

Option 1 - 1,000-Foot Vessels

Item		Costs	
W/O Riverside Park Cut			
Bank Cuts and Deepening		$ 533,065	Say $ .533 million
Conveyors		$14,580,000	Say $14.6 million
Site Development		$ 2,211,840	
Wharf Construction		726,250	
Material Handling System		5,000,000	
Special Purpose Vessel Loading Facility		$ 1,483,600	
Special Purpose Vessel		25,000,000	
Subtotal, Special Purpose Vessel and Facilities			$33,821,690
			Say $33.8 million
Utilities		$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS			Say $49.2 million
Estimated Annual Operation and Maintenance Costs			
5 MTPY	Power	$ 930,000	
	Repair and Maintenance	1,505,000	
	Labor	2,385,000	
	Insurance and Storage	425,000	
			$ 5,245,000
			$1.05/ton
8 MTPY	Power	$ 1,170,000	
	Repair and Maintenance	1,525,000	
	Labor	2,425,000	
	Insurance and Storage	425,000	
			$ 5,545,000
			$0.70/ton

Option 1 - 1,000-Foot Vessels

W/Riverside Park Cut

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Conveyors	$14,580,000	Say $14.6 million
Site Development	$ 1,640,640	
Wharf Construction	126,250	
Material Handling System	5,000,000	
Special Purpose Vessel Loading Facility	1,269,250	
Special Purpose Vessel	25,000,000	
Subtotal, Special Purpose Vessel and Facilities		$33,036,140 Say $33.0 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $48.4 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 930,000	
	Repair and Maintenance	1,505,000	
	Labor	2,385,000	
	Insurance and Storage	425,000	
			$ 5,245,000
			$1.05/ton
8 MTPY	Power	$ 1,170,000	
	Repair and Maintenance	1,525,000	
	Labor	2,425,000	
	Insurance and Storage	425,000	
			$ 5,545,000
			$0.70/ton

Option 2 - 1,200-Foot Vessels

W/O Riverside Park Cut

Item		Costs
Bank Cut and Deepening	$ 533,065	Say $ .533 million
Conveyors	$15,255,000	Say $15.2 million
Site Development	$ 2,211,840	
Wharf Construction	126,250	
Material Handling System	5,000,000	
Special Purpose Vessel Loading Facility	1,483,600	
Special Purpose Vessel	25,000,000	
Subtotal, Special Purpose Vessel and Facilities		$33,821,690 Say $33.8 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $49.8 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 935,000	
	Repair and Maintenance	1,520,000	
	Labor	2,385,000	
	Insurance and Storage	425,000	
			$ 5,265,000
			$1.05/ton
8 MTPY	Power	$ 1,180,000	
	Repair and Maintenance	1,540,000	
	Labor	2,425,000	
	Insurance and Storage	425,000	
			$ 5,570,000
			$0.70/ton

Option 2 - 1,200-Foot Vessels

W/Riverside Park Cut

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Conveyors	$15,255,000	Say $15.2 million
Site Development	$ 1,789,040	
Wharf Construction	126,250	
Material Handling System	5,000,000	
Special Purpose Vessel Loading Facility	1,269,250	
Special Purpose Vessel	25,000,000	
Subtotal, Special Purpose Vessel and Facilities		$33,184,540 Say $33.2 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $49.2 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 935,000	
	Repair and Maintenance	1,520,000	
	Labor	2,385,000	
	Insurance and Storage	425,000	
			$ 5,265,000
			$1.05/ton
8 MTPY	Power	$ 1,180,000	
	Repair and Maintenance	1,540,000	
	Labor	2,425,000	
	Insurance and Storage	425,000	
			$ 5,570,000
			$0.70/ton

LAKEFRONT TRANSSHIPMENT WITH RAIL FACILITIES

EVALUATION

The following assumptions were made and criteria established in preparing the preliminary design and cost estimates

for transshipment to U.S. Steel by rail. The rail car loading facility, fed by a conveyor system, would be a surge bin type hopper capable of flood loading the rail cars. The rail cars would be open top hopper cars with a cargo capacity of 100 tons per car. Two unit trains comprised of 50 open top hopper cars and 2 - 2250 HP locomotives operating simultaneously 24 hours per day, 5 days a week for the duration of the shipping season with an estimated cycle time of 4 hours would be capable of delivering 9.3 million tons of iron ore. This is 1.3 million tons more than is required by the future consumption estimate of 8,000,000 tons per year and yields a factor of safety of 1.16.

Upgrading of existing trackage would be required to facilitate rail shipments to U.S. Steel. Sufficient land area is not available to provide loop rail trackage at each end of the rail system. Train movements would have to move in reverse from U.S. Steel to return to the rail loading facility (see Plates 7-11 and 7-15).

COST ESTIMATES

Cost estimates for Lakefront transshipment with rail facilities are listed in Table 6.4 below. Each alternative has two options: Option 1 for 1,000-foot vessels and Option 2 for 1,200-foot vessels. Each cost estimate is divided into six areas: Bank Cuts and Deepening, Site Development, Wharf Construction, Material Handling System, Conveyors and Utilities. Site development includes trackwork.

TABLE 6.4 - NAVIGATION CONCEPT - LAKEFRONT TRANSSHIPMENT WITH RAIL FACILITIES

Option 1 - 1,000-Foot Vessels

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	796,540	
Wharf Construction	126,250	
Material Handling System	10,035,200	
Subtotal, Rail Facility and Improvements		$10,957,990 Say $11.0 million
Conveyors	$11,205,000	Say $11.2 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $23.0 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 645,000	
	Repair and Maintenance	710,000	
	Labor	1,095,000	
			$ 2,450,000
			$0.50/ton
8 MTPY	Power	$ 965,000	
	Repair and Maintenance	760,000	
	Labor	1,290,000	
			$ 3,015,000
			$0.40/ton

Option 2 - 1,200-Foot Vessels

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	796,540	
Wharf Construction	126,250	
Material Handling System	10,035,200	
Subtotal, Rail Facilities and Improvements		$10,957,990 Say $11.0 million

Conveyors		$11,542,500	Say $11.5 million
Utilities		$ 250,000	Say $ .25 million
DIRECT COSTS			Say $23.3 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 655,000	
	Repair and Maintenance	720,000	
	Labor	1,095,000	
			$ 2,470,000
			$0.50/ton
8 MTPY	Power	$ 980,000	
	Repair and Maintenance	770,000	
	Labor	1,290,000	
			$ 3,040,000
			$0.40/ton

LAKEFRONT TRANSSHIPMENT BY TRUCK SYSTEM

EVALUATION

Designs and cost estimates for truck transshipment to U.S. Steel were made based on the following considerations. Trucks would be heavy-duty, 55-ton haulers. The trucks would transport iron ore pellets from the transfer point upstream of the Erie Avenue Bridge to U.S. Steel. A conveyor system would direct the material flow to the truck loading facility. The truck loading facility would be a surge bin type hopper capable of quick loading the 55-ton haulers. A roadway would be constructed from the truck loading facility upriver to U.S. Steel. A cul-de-sac would be provided at each end of the roadway to facilitate quick turn-arounds. Material would be off loaded at a truck dump located on U.S. Steel property. The roadway would require 15-foot lanes, 12-foot shoulders, a reinforced concrete median barrier and an overall right-of-way width on the order of 70 feet.

Fencing would also be required along the entire length of the roadway.

A fleet of 16 trucks operating 24 hours per day, 7 days a week for the duration of the shipping season with an estimated cycle time of 32 minutes would be required to deliver the future consumption estimate of 8,000,000 tons per year to U.S. Steel. A minimum of 16 trucks are recommended to serve as a backup or reserve fleet.

COST ESTIMATES

Cost estimates for Lakefront transshipment to truck system are listed below. Each alternative has two options: Option 1 for 1,000-foot vessels and Option 2 for 1,200-foot vessels. Each cost estimate is divided into six areas: Bank Cuts and Deepening, Site Development, Wharf Construction, Material Handling System, Conveyors and Utilities.

TABLE 6.5 - NAVIGATION CONCEPT - LAKEFRONT TRANSSHIPMENT TO TRUCK SYSTEM

Option 1 - 1,000-Foot Vessels

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	$ 915,210	
Wharf Construction	126,250	
Material Handling System	14,942,750	
Subtotal, Truck Transfer Facility and Roadway		$15,984,210 Say $16.0 million
Conveyors	$11,205,000	Say $11.2 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $28.0 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 905,000	
	Repair and Maintenance	1,640,000	
	Labor	1,665,000	
			$ 4,210,000
			$0.85/ton
8 MTPY	Power	$ 1,355,000	
	Repair and Maintenance	2,245,000	
	Labor	2,140,000	
			$ 5,740,000
			$0.70/ton

Option 2 - 1,200-Foot Vessels

W/O Riverside Park Cut

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	$ 915,210	
Wharf Construction	126,250	
Material Handling System	14,942,750	
Subtotal, Truck Transfer Facility and Roadway		$15,984,210 Say $16.0 million
Conveyors	$11,542,500	Say $11.5 million
Utilities	$ 250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $28.3 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 915,000	
	Repair and Maintenance	1,650,000	
	Labor	1,665,000	
			$ 4,230,000
			$0.85/ton

8 MTPY	Power	$ 1,370,000	
	Repair and Maintenance	2,255,000	
	Labor	2,140,000	
			$ 5,765,000
			$0.70/ton

Option 2 - 1,200-Foot Vessels

W/Riverside Park Cut

Item		Costs
Bank Cuts and Deepening	$ 533,065	Say $ .533 million
Site Development	$ 915,210	
Wharf Construction	126,250	
Material Handling System	15,035,375	
Subtotal, Truck Transfer Facility and Roadway		$16,076,835 Say $16.1 million
Conveyors	$11,542,500	Say $11.5 million
Utilities	250,000	Say $ .25 million
TOTAL DIRECT COSTS		Say $28.4 million

Estimated Annual Operation and Maintenance Costs

5 MTPY	Power	$ 915,000	
	Repair and Maintenance	1,650,000	
	Labor	1,665,000	
			$ 4,230,000
			$0.85/ton
8 MTPY	Power	$ 1,370,000	
	Repair and Maintenance	2,255,000	
	Labor	2,140,000	
			$ 5,765,000 $0.70/ton

LAKEFRONT TRANSSHIPMENT RECOMMENDATIONS

The schemes proposed for Lakefront transshipment do not provide for direct vessel-to-shore unloading due to the lack of available land area along the Outer Harbor. This limitation could be overcome by utilizing Republic Steel's Taconite Terminal in the event the conveyor systems or relocated components would become inoperable.

SUMMARY

Significant cost savings can be realized by utilizing larger capacity vessels to transport bulk cargos on the Great Lakes. For approximately the same daily operating costs expended for smaller class vessels, 1,000 footers presently sailing the Lakes and future ships such as the theoretical 1,200-foot vessel addressed in this study could be employed. Onshore facilities capable of receiving and handling these greater bulk shipments will be required.

It is desirable to bring the terminal as close as possible to the materials' destination. In the case of Lorain Harbor, a transshipment facility could be located in the Outer Harbor at the Lakefront or along the Black River within the present three mile navigable channel. The transshipment facility would be constructed with a material handling system capable of moving bulk cargo in a continuous stream at a high rate comparable to the discharge rate of a self-unloader. The transshipment facility would provide an integrated system for moving material from vessel to shore to industrial consumer.

SECTION 7 - ALTERNATIVES CONSIDERED

INTRODUCTION

Sixteen alternatives were considered for study. These alternatives fall into the three categories of navigation concepts discussed in Section 1. These three concepts are: Concept 1 - Improve the harbor for navigation over the complete length of the currently authorized Federal project area (to the Upper Turning Basin); Concept 2 - Improve the harbor for navigation to the Lower Turning Basin below the 21st Street Bridge with transshipment from 21st Street to U.S. Steel; and Concept 3 - Improve the harbor for navigation in the Lakefront area only and provide transshipment from Lakefront to U.S. Steel.

Two options (Option 1 for 1,000-foot vessels and Option 2 for 1,200-foot vessels) were considered for each of these concepts. The construction items that have been previously discussed are identical for both options with one exception. In the case of the 1,200-foot vessel option, an additional construction item was considered. This item was the modification of the N&W railroad bridge to provide a vertical underclearance of 135-feet above Low Water Datum (LWD).

Concept 1 includes four alternative approaches to improving the entire navigation channel length for passage by the 1,000-foot (Option 1) or, as the case may be, 1,200-foot vessel (Option 2). These four alternatives essentially involved alternative construction items for allowing for the improved entrance to the Black River Channel. Included in Concept 1 are alternatives to: (1) construct a new channel entrance through Riverside Park; (2) replace the Erie Avenue Bridge with a high-level structure; (3) replace the Erie Avenue Bridge with a new movable bridge; and (4) replace the Erie Avenue Bridge with a tunnel under the Black River.

Also included in each of these alternatives is the replacement of the 21st Street Bridge with a higher structure.

The second category of alternatives is related to concepts to allow both sized vessels to navigate up the Black River to the Lower Turning Basin (Concept 2). The same alternative construction items as listed above for the first category of alternatives is also applicable to this category with the exception of replacement of the 21st Street Bridge. In lieu of the bridge replacement would be an upriver transshipment facility and a conveyor system constructed from the Lower Turning Basin to the U.S. Steel property. In the case of the 1,200-foot vessel option, modification to the N&W railroad bridge would still be required.

The third category considered (Concept 3) includes transshipment alternatives from the Lakefront area for upriver cargo movements. Four alternative transshipment methods have been considered: (1) conveyor; (2) special purpose vessel; (3) rail; and (4) truck. Each of the four Lakefront transshipment alternatives has been further subdivided into transshipment with the existing Black River channel entrance or with a new entrance through Riverside Park. The main reason for the further channel entrance improvements is to provide access to the American shipbuilding facility.

These construction items and their assemblance into the 16 alternatives considered in this study are shown on Tables 7-1 and 7-2. Each of these alternatives are detailed below.

Alternative 1 - This would include improvements for the entire project authorized area from the Outer Harbor to the

Upper Turning Basin. Plate 7-1 shows the various construction items of this alternative.

In the Outer Harbor, improvements would include removal of 600 feet of the East Breakwater and a 600-foot addition to the Outer Breakwater. A new Inner Habor Breakwater would be constructed to protect a future small boat marina along the East Shorearm Breakwater. The Outer Harbor would be dredged an additional three feet to allow larger vessels to enter. Outer Harbor dredging would amount to about 220,000 cubic yards.

The new channel would be constructed through Riverside Park. This realignment of the entrance to the Black River would permit vessel passage more nearly normal to the leaves of the existing Erie Avenue bascule bridge and would thereby eliminate replacement of this bridge. In addition, cuts would be made along the existing channel to the Upper Turning Basin. These associate channel cuts and Upper Turning Basin improvements amount to approximately 1,200,000 and 1,500,000 cubic yards for the 1,000- and 1,200-foot vessels, respectively, and would significantly improve maneuvering and bank clearance lanes for both 1,000-foot and 1200-foot sized vessels. The river channel would be deepened to 27 feet. Dredging quantities would amount to 2,500,000 and 3,100,000 cubic yards, respectively, for the 1,000- and 1,200-foot options.

Upriver, the 21st Street high-level bridge would be replaced with a similar structure. Slight relocation of the bridge would result in both local and through-traffic moving more freely due to the elimination of the complex 21st Street-Elyria Avenue intersection and street relocations. Some predominantly commercial areas would be permanently taken with no equivalent return upon removal of the existing structure.

In addition to the above items, the 1,200-foot vessel option would require modifications to the N&W lift bridge. This item is limited to structural and mechanical modifications to provide 135-foot understructure clearance at full lift.

The estimated cost for the 1,000-foot option is $157.0 million and for the 1,200-foot option is $177.0 million. Cost breakdowns for both options are shown on Tables 7-3 and 7-4.

Alternative 2 - This alternative would be similar to Alternative 1, except in lieu of constructing the new channel through Riverside Park, the existing river entrance would remain; and the existing Erie Avenue Bridge would be replaced with a high-level structure. These construction items are shown on Plate 7-2. The Outer Harbor would not require a marina breakwater.

The proposed high-level bridge replacement at Erie Avenue would be a three-span continuous, through-truss structure. The total length, which includes approach fills, approach spans, and the three-span truss structure, would be approximately 5,000 feet. Access by local traffic to the downtown area would be adversely affected to some degree. The existing structure would remain in service until the high-level bridge was opened to traffic. Disruption of traffic during construction would be minimal and of short duration. Large areas of predominantly residential land would be taken for construction and permanent easement. The structure would have a substantial visual impact, particularly to those on the land side of the structure since it would dominate the skyline. In essence, this structure would not only bridge the river but the entire downtown area.

Costs for this alternative would be $204.0 million for the 1,000-foot option and $230.3 million for the 1,200-foot vessel option and are shown in detail on Tables 7-5 and 7-6 respectively. Harbor maintenance would not be affected to a significant degree by this alternative.

Alternative 3 - Instead of replacement of the Erie Avenue Bridge with a high level structure, a new movable bridge at Erie Avenue would be constructed. All other construction items in this alternative are identical to Alternative 2. The necessary changes to the harbor and channel for this alternative are shown on Plate 7-3.

Replacement of the Erie Avenue Bridge with a new movable bridge would minimize adverse impacts on traffic during construction and on relocation of residences. The existing bascule structure would be replaced by a lift bridge similar in style to the N&W railroad lift bridge that is upriver of Erie Avenue. The new lift bridge would be located immediately upstream or downstream of the existing bridge. The lift bridge would have essentially identical functional characteristics and effects on traffic and land use as the existing structure. The principal permanent impact would be the presence of the lift bridge towers which would stand approximately 200 feet above water.

Total first costs for this alternative would be $176.0 million for the 1,000-foot option and $205.0 million for the 1,200foot option. Details of these total costs are provided in Tables 7-7 and 7-8.

Alternative 4 - The only difference in this alternative from Alternatives 2 and 3 is again the option of replacing the Erie Avenue Bridge which would be replaced in this alternative by a tunnel under the river (see Plate 7-4).

A tunnel replacement for the existing Erie Avenue Bridge would have four 13-foot traffic lanes, two 2-1/2-foot emergency sidewalks and a 6-foot pedestrian passageway. The total tunnel length would be approximately 3,000 feet with 1,000 feet constructed under water. Tunnel portals would be aligned with Erie Avenue, with grade intersection at Hamilton Street to the south and near Delaware Street to the north. Some widening of Erie Avenue in these locations would be required. Crosstown traffic would travel substantially the same distance with fewer intersections. Local traffic would be adversely affected in varying degrees depending on the relation of the point of origin and destination to the tunnel entrances. Interruption of traffic for the passage of vessels on the river would be eliminated.

The existing bascule structure would remain in service until the tunnel was opened to traffic. Tunnel construction along Erie Avenue would require considerable long-term rerouting of traffic to other streets and a limited amount of temporary road construction at the approaches to the present bridge. Construction and engineering costs for this alternative are detailed for both vessel size options in Tables 7-9 and 7-10. Total costs for the 1,000-foot option are estimated at $235.0 million and $260.0 million for the 1,200-foot option.

<u>Alternative 5</u> - This alternative, the first of "the navigation to the Lower Turning Basin" concepts, features the new channel through Riverside Park and the construction of a transshipment conveyor facility below 21st Street (see Plate 7-5).

Outer Harbor navigation improvements would include the Inner Harbor Breakwater to protect the small boat marina. A new channel would be cut through Riverside Park and channel

enlargement would be required, but only to below the 21st Street Bridge. The east bank at the Lower Turning Basin would be enlarged to provide easier turning maneuverability for the larger vessels. Excavating and dredging requirements for the improved channel would amount to 1,850,000 cubic yards for the 1,000-foot option and 2,184,000 for the 1,200-foot option, excluding the cut through Riverside Park. The quantity of material required to be removed for the Riverside Park cut would be 270,000 cubic yards for the 1,000-foot option and 367,000 cubic yards for the 1,200-foot option.

The outstanding feature of this alternative would be the construction of a transshipment facility located on the east bank of the Black River just below the 21st Street Bridge. The facility would employ a conveyor system to complete the transfer of material upriver. A bridge spanning the Black River would be required to convey material to the U.S. Steel Lorain-Cuyahoga Works located on the west bank of the river. The total length of the belt-conveyor required would be approximately 4,000 feet.

Costs for this alternative are shown in Tables 7-11 and 7-12. Total costs for the 1,000-foot vessel option would be $93.4 million. For the 1,200-foot vessel option costs would total $105.9 million.

Alternative 6 - Construction items included in Alternative 6 are shown on Plate 7-6. The differing feature of this alternative from the previous one would be replacement of the Erie Avenue Bridge with a high-level structure in lieu of the cut through Riverside Park. Included, however, would be the Mid-way transshipment facility. These items have been previously discussed.

Costs for this alternative are detailed in Tables 7-13 and 7-14. The 1,000-foot vessel option cost would total $136.0 million, while the 1,200-foot vessel option cost would total $166.0 million.

Alternative 7 - Again, this alternative would be identical to Alternatives 5 and 6 in all ways except that the Erie Avenue Bridge would be replaced with a new movable bridge. This bridge would have the same features as those described in Alternative 3.

Costs for this alternative are detailed in Tables 7-15 and 7-16. The 1,000-foot vessel option cost would total $111.0 million, while the 1,200-foot vessel option cost would total $131.0 million.

Alternative 8 - This alternative has all the features of Alternatives 5 to 7 with the exception that the existing Erie Avenue Bridge would be replaced with a tunnel under the Black River. The tunnel would be identical to that described in Alternative 4.

Costs for this alternative would total $171.0 million for the 1,000-foot option and $187.0 million for the 1,200-foot option. These costs are detailed in Tables 7-17 and 7-18.

Alternative 9 - This is the first alternative to apply Concept 3 - navigation to the Lakefront and transshipment upriver to U.S. Steel. Lakefront navigation improvements would include maintaining the existing river channel entrance, removing a 600-foot section of the East Breakwater and lengthening by 600 feet the Outer Breakwater. Preliminary studies indicate that both 1,000- and 1,200-foot vessels will be able to maneuver to a Lakefront transshipment facility

without need for modifications to the West Breakwater. The Outer Harbor area would be deepened by approximately three feet. Construction items included in this alternative are shown in Plate 7-9.

It is proposed that the existing coal slip be used for the berthing area for the transshipment facility. Utilization of this area of the Outer Harbor will accommodate the transshipment area to serve U.S. Steel upriver and the proposed Lakefront transshipment facility by Republic Steel Corporation that will serve its Cleveland and hinterland plants. The east pier, selected as the wharf for the proposed transshipment facility, would require renovation and structural modification to render it suitable for a docking facility. The coal slip area would also require dredging. This would enable berthing of both 1,000- and 1,200-foot vessels. For this alternative, a conveyor system would be used to transport the off-loaded iron ore upriver to the U.S. Steel Plant. The system would be fed by a dock hopper erected on the east pier which would receive the shipments and direct the material flow to a transfer station for subsequent routing to a storage or continued movement upriver. Approximately 1,500 lineal feet of tunnel construction would be required to permit the conveyor, running between the dock hopper and the transfer station, to pass beneath Republic's pellet storage piles and an additional 30 lineal feet of tunnel would be necessary to pass a below grade rail crossing. The conveyor system would meander upriver, pass beneath the approach ramp to the 21st Street Bridge and terminate at U.S. Steel. Elevated structures would be required to bridge East Ninth Street and the N&W railroad tracks. The conveyor would be enclosed for safety and to diminish noise pollution. Dust collection systems would be provided at transfer points.

The total cost for the Lakefront transshipment and upriver conveyor alternative would be $55.4 million for the 1,000-foot option and $63.4 million for the 1,200-foot option. These costs are detailed in Tables 7-19 and 7-20.

Alternative 10 - This alternative would be identical to Alternative 9 in all ways but one. In lieu of the conveyor system, an upriver special purpose vessel facility would be constructed. The special purpose vessel would be a highly maneuverable craft suitable for river navigation as well as open lake navigation. The self-unloading vessel would have a cargo carrying capacity of approximately 20,000 tons. The berthing facility for this vessel would be constructed on the west bank of the Black River just upstream from Erie Avenue. A turning basin would also be constructed at this point to enable the vessel to turn around. The facility would include a ship loader which would be able to load the special purpose vessel at a rate of 2,500 tons per hour. Conveyors between the Lakefront transshipment area and the special purpose vessel facility would be constructed to move material. To meet the annual anticipated through-put of 8-million tons of iron ore by U.S. Steel, the special purpose vessel would need to operate 16 hours per day, six days a week for the duration of the shipping season.

Detailed cost estimates for this alternative are listed in Tables 7-21 and 7-22. Total costs for the 1,000-foot option would be $85.4 million. For the 1,200-foot option, total costs would be $86.4 million.

Alternative 11 - In lieu of a conveyor system for the special purpose vessel, material could be shipped upriver via the existing rail system. All other components of this alternative would be identical to the previous two alternatives (see Plate 7-11).

The rail car loading facility, fed by a conveyor system, would be a surge bin type hopper capable of flood loading the rail cars. The hopper cars would have a cargo capacity of 100 tons each. The material could be moved upriver by 50 car unit trains. To move the amount of material anticipated would require two unit trains operating simultaneously 24 hours per day, 5 days a week for the duration of the shipping season. Cycle time for loading and delivery upriver is estimated to be four hours. While there is existing trackage, the rail would require upgrading in order to carry the anticipated loads.

Cost estimates for this alternative are detailed on Tables 7-23 and 7-24. For the 1,000-foot option the total cost would be $45.4 million, and for the 1,200-foot option the cost would be $46.1 million.

Alternative 12 - Again, transshipment facilities at the Lakefront and all other associated construction items would be identical to Alternatives 9, 10 and 11 (see Plate 7-12). The outstanding feature of Alternative 12 would be the construction of an upriver truck system to carry material as far as the U.S. Steel property.

From the transshipment facility, a conveyor system would direct the material flow to the truck loading facility along the Black River. The facility would be a surge bin type hopper capable of quick loading 55 ton trucks. A roadway which parallels the river would be constructed from the truckloading facility upriver to U.S. Steel. Truck turnarounds would be provided at each end. The exclusive roadway would require 15-foot lanes, 14-foot shoulders, a reinforced concrete median barrier and an overall right-of-way width on the order of 70 feet. Fencing would also be required along the entire length of the private roadway. A

fleet of 16 trucks operating 24 hours per day, seven days a week for the duration of the shipping season would be required. Cycle time for loading, traveling, unloading and returning is estimated at 32 minutes.

Cost estimates for this Lakefront transshipment with truck system alternatives are detailed in Tables 7-25 and 7-26 for the 1,000- and 1,200-foot options, respectively. The 1,000-foot option total cost is estimated to be $53.8 million. Costs for the 1,200-foot option with this alternative is estimated to be $54.2 million.

Alternative 13 - This alternative is identical to Alternative 9 in all ways except for an added construction item. This additional item is the construction of a new channel through Riverside Park. The construction of the Riverside Park cut would enable easy access to the American Shipbuilding facility by the larger vessels. The components of this alternative are shown in Plate 7-13.

Cost estimates for this alternative are detailed in Tables 7-27 and 7-28. The costs for the Riverside Park cut would increase the total costs for this alternative to $73.1 million for the 1,000-foot option and $76.8 million for the 1,200-foot option.

Alternative 14 - This alternative will have the features identical to Alternative 10 with the addition of the cut through Riverside Park to service the American Shipbuilding facility (see Plate 7-14).

Detailed costs for this alternative are shown in Tables 7-29 and 7-30. The total cost for the 1,000-foot option would be $101.4 million. Total cost for the 1,200-foot option is estimated to be $106.0 million.

Alternative 15 - This alternative includes transshipment from Lakefront by rail with the new channel through Riverside Park to provide access by large vessels to the American Shipbuilding facility (see Plate 7-15).

Detailed costs are shown in Tables 7-31 and 7-32. The total cost for the 1,000-foot option is estimated to be $62.6 million. The total cost for the 1,200-foot option is estimated to be $66.1 million.

Alternative 16 - The final alternative is for Lakefront transshipment with the upriver truck system and the new channel through Riverside Park, and is detailed on Plate 7-16.

Total costs for the 1,000-foot option are estimated to be $[illegible].9 million, and the total costs for the 1,200-foot option are estimated to be $73.7 million. These costs are detailed in Tables 7-33 and 7-34.

TABLE 7.1

LORAIN HARBOR NAVIGATION IMPROVEMENTS
1000 FOOT VESSEL OPTION

Construction Item	Alternatives															
	1	2	3	4	5	6		8	9	10	11	12	13	14	15	16
A. Enlarge or Reorient Outer Harbor Entrance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
B. Construct New Channel thru Riverside Park	X				X								X	X	X	X
C. Replace Erie Avenue Bridge with High Level Structure		X				X										
D. Replace Erie Avenue Bridge with Movable Bridge			X				X									
E. Replace Erie Avenue Bridge with Tunnel under River				X				X								
F. Enlarge Channel	X	X	X	X	X	X	X	X								
G. Enlarge the Lower Turning Basin					X	X	X	X								
H. Enlarge the Upper Turning Basin	X	X	X	X												
I. Replace 21st Street Bridge with Higher Structure	X	X	X	X												
J. Construct Conveyor Transfer Facility Below 21st Street					X	X	X	X								
K. Construct Conveyor System Upriver from 21st Street					X	X	X	X								
L. Construction Transshipment Facility at Lakefront									X	X	X	X	X	X	X	X
M. Construct Upriver Conveyor System									X				X			
N. Construct Upriver Special Purpose Vessel Facility										X				X		
O. Construct Upriver Rail Facility											X				X	
P. Construct Upriver Truck System												X				X

TABLE 7.2

LORAIN HARBOR NAVIGATION IMPROVEMENTS
1200 FOOT VESSEL OPTION

Construction Item	Alternatives															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	15
A. Enlarge or Reorient Outer Harbor Entrance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
B. Construct New Channel thru Riverside Park	X				X								X	X	X	X
C. Replace Erie Avenue Bridge with High Level Structure		X				X										
D. Replace Erie Avenue Bridge with Movable Bridge			X				X									
E. Replace Erie Avenue Bridge with Tunnel under River				X				X								
F. Enlarge Channel	X	X	X	X	X	X	X	X								
G. Enlarge the Lower Turning Basin					X	X	X	X								
H. Enlarge the Upper Turning Basin	X	X	X	X												
I. Replace 21st Street Bridge with Higher Structure	X	X	X	X												
J. Construct Conveyor Transfer Facility Below 21st Street					X	X	X	X								
K. Construct Conveyor System Upriver from 21st Street					X	X	X	X								
L. Construction Transshipment Facility at Lakefront									X	X	X	X	X	X	X	X
M. Construct Upriver Conveyor System									X				X			
N. Construct Upriver Special Purpose Vessel Facility										X				X		
O. Construct Upriver Rail Facility											X				X	
P. Construct Upriver Truck System												X				X
Q. Modify N&W Railroad Bridge	X	X	X	X	X	X	X	X								

TABLE 7.3
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 1 OPTION 1 (1,000- FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.3)*				37.8			37.8
Breakwaters	3.90						3.90
Bank Cuts & Deepening (2.5)	2.90	14.4	14.2	23.1			54.6
Building Demolition (2.5, 3.4)		1.0	.060				1.06
Conveyors (3.4)							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4)		1.03					1.03
Subtotal Direct Costs	6.8	16.4	14.3	60.9			98.4
Contractor's Overhead & Profit @ 15%	1.02	2.46	2.15	9.14			14.8
Subtotal	7.82	18.9	16.5	70.0			113.0
Contingency @ 15%	1.17	2.84	2.48	10.5			17.0
Subtotal	8.99	21.7	18.9	80.5			130.0
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.26	2.84	12.1			19.6
Subtotal	10.3	25.0	21.7	92.6			150.0
Land (3.4, 4.3)		1.86	1.71	4.03			7.60
TOTAL NAVIGATION COSTS	10.3	26.9	23.4	96.6			157.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.4
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 1 OPTION 2 (1,200- FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.3)*			0.30	37.8			38.1
Breakwaters (2.5)	3.90						3.9
Bank Cuts & Deepening (2.5, 3.5)	2.90	16.4	22.0	26.0			67.3
Building Demolition (3.5)		1.6	.06				1.66
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5)		1.1					1.1
Subtotal Direct Costs	6.8	19.1	22.4	63.8			112.0
Contractor's Overhead & Profit @ 15%	1.02	2.86	3.36	9.57			16.8
Subtotal	7.82	22.0	25.8	73.4			129.0
Contingency @ 15%	1.17	3.3	3.87	11.0			19.3
Subtotal	8.99	25.3	29.7	84.4			148.0
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.79	4.45	12.7			22.3
Subtotal	10.3	29.1	34.1	97.1			171.0
Land (3.5, 4.3)		.2	2.6	4.1			6.9
TOTAL NAVIGATION COSTS	10.3	29.3	36.7	101.2			177.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.5
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 2 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.1, 4.3)*		32.6		37.8			70.4
Breakwaters (2.4)	2.60	11.8	14.2	23.1			51.7
Bank Cuts & Deepening (2.4, 3.4)	2.80	.032	.060				2.89
Building Demolition							
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 4.1)		.823					.823
Subtotal Direct Costs	5.40	45.3	14.3	60.9			126.0
Contractor's Overhead & Profit @ 15%	0.81	6.80	2.15	9.14			18.9
Subtotal	6.21	52.1	16.5	70.0			145.0
Contingency @ 15%	0.93	7.82	2.48	10.5			21.7
Subtotal	7.14	59.9	18.9	80.5			166.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	8.99	2.84	12.1			25.0
Subtotal	8.21	68.9	21.7	92.6			191.0
Land (3.4, 4.1, 4.3)		6.61	1.71	4.03			12.4
TOTAL NAVIGATION COSTS	8.21	75.5	23.4	96.6			204.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.6
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 2 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.1, 4.3)*		33.6	.3	37.8			71.7
Breakwaters (2.4)	2.6						2.6
Bank Cuts & Deepening(2.4, 3.5)	2.8	16.5	22.0	25.9			67.2
Building Demolition (3.5)		.03	.06				.09
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5, 4.1)		.7					.7
Subtotal Direct Costs	5.40	50.8	22.4	63.7			142.3
Contractor's Overhead & Profit @ 15%	.810	7.62	3.35	9.56			21.34
Subtotal	6.21	58.4	25.8	73.26			163.67
Contingency @ 15%	.93	8.76	3.87	10.99			24.55
Subtotal	7.14	67.1	29.7	84.25			188.19
Engineering & Design, Supervision & Adm. @ 15%	1.07	10.1	4.45	12.64			28.26
Subtotal	8.21	77.2	34.2	96.89			216.50
Land (3.5, 4.1, 4.3)		7.1	2.60	4.1			13.8
TOTAL NAVIGATION COSTS	8.21	84.3	36.8	100.99			230.30

*( ) *Indicates Table in previous section(s) detailing these costs.*

TABLE 7.7
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 3 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.2, 4.3)*		17.3	0.30	37.8			55.1
Breakwaters (2.4)	2.60						2.6
Bank Cuts & Deepening (2.4, 3.4)	2.80	11.8	14.2	23.1			51.9
Building Demolition (3.4)		.032	.060				0.09
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 4.2)		1.52					1.52
Subtotal Direct Costs	5.40	30.7	14.3	60.9			111.0
Contractor's Overhead & Profit @ 15%	0.81	4.61	2.15	9.14			16.7
Subtotal	6.21	35.3	16.5	70.0			128.0
Contingency @ 15%	0.93	5.30	2.48	10.5			192.0
Subtotal	7.14	40.6	19.0	80.5			147.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	6.09	2.85	12.1			22.1
Subtotal	8.21	46.7	21.9	92.6			169.0
Land (3.4, 4.2, 4.3)		1.91	1.71	4.03			5.94
TOTAL NAVIGATION COSTS	8.21	48.6	23.6	96.6			176.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.8
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 3 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.2, 4.3)*		19.0	.3	37.8			57.1
Breakwaters (2.4)	2.6						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.8	16.4	22.0	26.0			67.2
Building Demolition (3.5)		.03	.06				.09
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5, 4.2)		1.54					1.54
Subtotal Direct Costs	5.4	36.97	22.4	63.8			129.0
Contractor's Overhead & Profit @ 15%	.81	5.53	3.35	9.57			19.3
Subtotal	6.21	42.5	25.7	73.4			149.0
Contingency @ 15%	.93	6.38		11.0			18.3
Subtotal	7.14	48.9	29.6	84.4			126.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	7.34	4.44	12.7			25.5
Subtotal	8.21	56.3	34.0	97.1			196.0
Land (3.5, 4.2, 4.3)		2.4	2.6	4.1			9.1
TOTAL NAVIGATION COSTS	8.21	58.7	36.6	101.2			205.0

*( ) Indicates Tables in previous section(s) detailing these costs.

TABLE 7.9
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 4 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.3)*				37.8			37.8
Breakwaters (2.4)	2.60						2.60
Bank Cuts & Deepening (2.4, 3.4)	2.80	11.8	14.2	23.1			52.9
Building Demolition (3.4)		.032	.060				0.09
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel (5.1)		53.8					53.8
Utilities(3.4, 5.1)		1.22					1.22
Subtotal Direct Costs	5.40	66.9	14.3	60.9			148.0
Contractor's Overhead & Profit @ 15%	0.81	10.0	2.15	9.14			22.1
Subtotal	6.21	76.9	16.5	70.0			170.0
Contingency @ 15%	0.93	11.5	2.48	10.5			25.4
Subtotal	7.14	88.4	19.0	80.5			195.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	13.3	2.85	12.1			29.3
Subtotal	8.21	102.0	21.9	92.6			225.0
Land (3.4, 4.3, 5.1)		4.82	1.71	4.03			10.6
TOTAL NAVIGATION COSTS	8.21	107.0	23.6	96.6			235.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.10
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 4 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.3)*			.3	37.8			38.1
Breakwaters (2.4)	2.60						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.80	16.4	22.0	26.0			67.2
Building Demolition (3.5)		.03	.06				.09
Conveyors							
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel (5.1)		53.8					53.8
Utilities (3.5, 5.1)		1.24					1.24
Subtotal Direct Costs	5.4	71.5	22.4	63.8			163.1
Contractor's Overhead & Profit @ 15%	.81	10.7	3.36	9.57			24.44
Subtotal	6.21	82.2	25.8	73.4			187.6
Contingency @ 15%	.93	12.3	3.87	11.0			28.1
Subtotal	7.14	94.5	29.7	84.4			215.7
Engineering & Design, Supervision & Adm. @ 15%	1.07	14.2	4.46	12.7			32.43
Subtotal	8.21	108.7	34.2	97.1			248.0
Land (3.5, 4.3, 5.1)		5.3	2.6	4.1			12.0
TOTAL NAVIGATION COSTS	8.2	114.0	36.8	101.2			260.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.11
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 5 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.5)*	3.90						3.9
Bank Cuts & Deepening (2.5, 3.4)	2.90	14.4	17.9				35.2
Building Demolition (3.4)		1.0	.060				1.06
Conveyors (6.1)			15.9				15.9
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 6.1)		1.0	.250				1.25
Subtotal Direct Costs	6.80	16.4	34.1				57.3
Contractor's Overhead & Profit @ 15%	1.02	2.46	5.12				8.60
Subtotal	7.82	18.9	39.2				65.9
Contingency @ 15%	1.17	2.84	5.88				9.89
Subtotal	8.99	21.7	45.1				75.8
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.26	6.77				11.4
Subtotal	10.3	25.0	51.9				87.2
Land (3.4, 6.1)		1.86	4.37				6.23
TOTAL NAVIGATION COSTS	10.3	26.9	56.3				93.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.12
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 5 : OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges			.3				.3
Breakwaters (2.5)*	3.9						3.9
Bank Cuts & Deepening (2.5, 3.5)	2.9	16.4	22.0				41.3
Building Demolition (3.5)		1.6	.06				1.66
Conveyors (6.1)			16.7				16.7
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5, 6.1)		1.1	.3				1.4
Subtotal Direct Costs	6.8	19.1	39.4				65.3
Contractor's Overhead & Profit @ 15%	1.02	2.87	5.91				9.80
Subtotal	7.82	22.0	45.3				75.1
Contingency @ 15%	1.17	3.3	6.79				11.26
Subtotal	8.99	25.3	52.1				86.3
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.79	7.81				12.9
Subtotal	10.3	29.1	59.9				99.3
Land (3.5, 6.1)		2.0	4.6				6.6
TOTAL NAVIGATION COSTS	10.3	31.1	64.5				105.9

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.13
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 6 OPTION - (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.1)*		32.6					32.6
Breakwaters (2.4)	2.60						2.6
Bank Cuts & Deepening (2.4, 3.4)	2.80	11.8	17.9				32.5
Building Demolition (3.4)		.032	.060				0.09
Conveyors (6.1)			15.9				15.9
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 4.1, 6.1)		0.62	.250				0.87
Subtotal Direct Costs	5.40	44.5	34.1				84.0
Contractor's Overhead & Profit @ 15%	0.81	6.68	5.12				12.6
Subtotal	6.21	51.2	39.2				96.6
Contingency @ 15%	0.93	7.68	5.88				14.5
Subtotal	7.14	58.9	45.1				111.1
Engineering & Design, Supervision & Adm. @ 15%	1.07	8.84	6.77				16.7
Subtotal	8.21	67.7	51.9				127.8
Land (3.4, 4.1, 6.1)		6.57	2.10				8.67
TOTAL NAVIGATION COSTS	8.21	74.3	54.0				136.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.14
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 6 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.1)*		33.6	0.30				33.9
Breakwaters (2.4)	2.60						2.6
Bank Cuts & Deepening (2.4, 3.[illegible])	2.80	16.5	22.0				41.3
Building Demolition (3.5)		.03	.06				.09
Conveyors (6.1)			16.7				16.7
Rail Facilit[illegible] Improvements							
Special Purpo[illegible]el & Facility							
Truck Transfer Facility [illegible]oadway							
Tunnel							
Utilities (3.5, 4.1, 6.1)		.1	.25				.4
Subtotal Direct Costs	5.4	50.2	39.3				94.9
Contractor's Overhead & Profit @ 15%	.81	7.53	5.89				14.2
Subtotal	6.21	57.7	45.2				109.0
Contingency @ 15%	.93	8.66	6.78				16.4
Subtotal	7.14	66.4	52.0				125.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	9.96	7.8				18.8
Subtotal	8.21	76.4	59.8				144.0
Land (3.5, 4.1, 6.1)		7.05	4.6				11.65
TOTAL NAVIGATION COSTS	8.21	83.4	64.4				166.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.15
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 7 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.2)*		17.3					17.3
Breakwaters (2.4)	2.60						2.6
Bank Cuts & Deepening (2.4, 3.4)	2.80	11.8	17.9				32.5
Building Demolition (3.4)		.032	.060				0.09
Conveyors (6.1)			15.9				15.9
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 4.2, 6.1)		1.52	.250				1.77
Subtotal Direct Costs	5.40	30.7	34.1				70.2
Contractor's Overhead & Profit @ 15%	0.81	4.61	5.12				10.5
Subtotal	6.21	35.3	39.2				80.7
Contingency @ 15%	0.93	5.30	5.88				12.1
Subtotal	7.14	40.6	45.1				92.8
Engineering & Design, Supervision & Adm. @ 15%	1.07	6.09	6.77				13.9
Subtotal	8.21	46.7	51.9				107.0
Land (3.4, 4.2, 6.1)		1.91	2.09				4.00
TOTAL NAVIGATION COSTS	8.21	48.6	54.0				111.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.16
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 7 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges (4.2)*		19.0	0.30				19.3
Breakwaters (2.4)	2.6						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.8	16.5	22.0				41.3
Building Demolition (3.5)		.03	.06				.09
Conveyors (6.1)			16.7				16.7
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5, 4.2, 6.1)		1.54	.25				1.79
Subtotal Direct Costs	5.4	37.1	39.3				81.8
Contractor's Overhead & Profit @ 15%	.81	5.56	5.89				12.3
Subtotal	6.21	42.7	45.2				94.1
Contingency @ 15%	.93	6.40	6.78				14.1
Subtotal	7.14	49.1	52.0				108.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	7.36	7.8				16.2
Subtotal	8.21	56.5	59.8				124.0
Land (3.5, 4.2, 6.1)		2.4	4.6				7.0
TOTAL NAVIGATION COSTS	8.21	58.9	64.4				131.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.17
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 8 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.60						2.60
Bank Cuts & Deepening (2.4, 3.4)	2.80	11.8	17.9				32.5
Building Demolition (3.4)		.032	.060				0.09
Conveyors (6.1)			15.9				15.9
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel (5.1)		53.8					53.8
Utilities (3.4, 5.1, 6.1)		1.22	.250				1.47
Subtotal Direct Costs	5.40	66.9	34.1				106.0
Contractor's Overhead & Profit @ 15%	0.81	10.0	5.12				15.9
Subtotal	6.21	76.9	39.2				122.0
Contingency @ 15%	0.93	11.5	5.88				18.3
Subtotal	7.14	88.4	45.1				141.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	13.3	6.77				21.1
Subtotal	8.21	102.0	51.9				162.0
Land (3.4, 5.1, 6.1)		4.82	4.39				9.21
TOTAL NAVIGATION COSTS	8.21	107.0	56.3				171.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.18
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 8 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges			0.30				0.30
Breakwaters (2.4)*	2.6						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.8	16.5	22.0				41.3
Building Demolition (3.5)		.03	.06				.09
Conveyors (6.1)			16.7				16.7
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel (5.1)		53.8					53.8
Utilities (3.5, 5.1, 6.1)		1.24	.25				1.49
Subtotal Direct Costs	5.4	71.57	39.3				116.0
Contractor's Overhead & Profit @ 15%	.81	10.7	5.89				17.4
Subtotal	6.21	82.3	45.2				134.0
Contingency @ 15%	.93	12.4	6.78				20.1
Subtotal	7.14	94.7	52.0				154.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	14.2	7.8				23.1
Subtotal	8.21	109.0	59.8				177.0
Land (3.5, 5.1, 6.1)		5.3	4.6				9.9C
TOTAL NAVIGATION COSTS	8.21	114.3	64.4				187.0

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.19
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 9 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.60						2.60
Bank Cuts & Deepening (2.4, 3.4)	2.80	.533					3.33
Building Demolition							
Conveyors (6.2)		7.09	22.3				29.4
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (6.2)			.250				.250
Subtotal Direct Costs	5.40	7.62	22.6				35.6
Contractor's Overhead & Profit @ 15%	0.81	1.14	3.39				5.34
Subtotal	6.21	8.76	26.0				41.0
Contingency @ 15%	0.93	1.31	3.90				6.14
Subtotal	7.14	10.1	29.9				47.1
Engineering & Design, Supervision & Adm. @ 15%	1.07	1.51	4.49				7.07
Subtotal	8.21	11.6	34.4				54.2
Land (6.2)			1.16				1.16
TOTAL NAVIGATION COSTS	8.21	11.6	35.6				55.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.20
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 9 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.6						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.8	5.3					8.1
Building Demolition							7.1
Conveyors (6.2)		7.09	22.7				29.8
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (6.2)			.25				.25
Subtotal Direct Costs	5.4	12.4	23.0				40.8
Contractor's Overhead & Profit @ 15%	.81	1.86	3.45				6.12
Subtotal	6.21	14.3	26.5				47.01
Contingency @ 15%	.93	2.14	3.97				7.04
Subtotal	7.14	16.4	30.5				54.0
Engineering & Design, Supervision & Adm. @ 15%	1.07	2.46	4.57				8.1
Subtotal	8.21	18.9	35.1				
Land (6.2)			1.2				1.2
TOTAL NAVIGATION COSTS	8.21	18.9	36.3				63.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.21
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 10 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.60						2.60
Bank Cuts & Deepening (2.4, 3.4)	2.80	.533					3.33
Building Demolition							
Conveyors (6.3)		6.64	7.94				14.6
Rail Facility & Improvements							
Special Purpose Vessel & Facility			33.8				33.8
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (6.3)			.250				.250
Subtotal Direct Costs	5.40	7.17	42.0				54.6
Contractor's Overhead & Profit @ 15%	0.81	1.08	6.30				8.19
Subtotal	6.21	8.25	48.3				62.8
Contingency @ 15%	0.93	1.24	7.25				9.42
Subtotal	7.14	9.49	55.6				72.2
Engineering & Design, Supervision & Adm. @ 15%	1.07	1.42	8.34				10.8
Subtotal	8.21	10.9	63.9				83.0
Land (6.3)			2.43				2.43
TOTAL NAVIGATION COSTS	8.21	10.9	66.3				85.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.22
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 10 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.6						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.8	.533					3.3
Building Demolition							
Conveyors (6.3)		6.64	8.6				15.23
Rail Facility & Improvements							
Special Purpose Vessel & Facility (6.3)			33.8				33.8
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (6.3)			.25				.25
Subtotal Direct Costs	5.4	7.17	42.7				55.27
Contractor's Overhead & Profit @ 15%	.81	1.07	6.40				8.28
Subtotal	6.21	8.24	49.10				63.5
Contingency @ 15%	.93	1.24	7.36				9.33
Subtotal	7.14	9.48	56.5				73.1
Engineering & Design, Supervision & Adm. @ 15%	1.07	1.42	8.47				11.0
Subtotal	8.21	10.9	64.9				84.0
Land (6.3)			2.4				2.4
TOTAL NAVIGATION COSTS	8.21	10.9	67.3				86.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.23
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 11 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.60						2.60
Bank Cuts & Deepening (2.4, 3.4)	2.80	.533					3.33
Building Demolition							
Conveyors (6.4)		6.64	4.57				11.2
Rail Facility & Improvements (6.4)		.451	10.5				11.0
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (6.4)			.250				.250
Subtotal Direct Costs	5.40	7.62	15.3				28.3
Contractor's Overhead & Profit @ 15%	0.81	1.14	2.30				4.25
Subtotal	6.21	8.76	17.6				32.6
Contingency @ 15%	0.93	1.31	2.64				4.88
Subtotal	7.14	10.1	20.2				37.4
Engineering & Design, Supervision & Adm. @ 15%	1.07	1.52	3.03				5.62
Subtotal	8.21	11.6	23.2				43.0
Land (6.4)			2.43				2.43
TOTAL NAVIGATION COSTS	8.21	11.6	25.6				45.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.24
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 11 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.6						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.8	.533					3.33
Building Demolition							
Conveyors (6.4)		6.64	4.9				11.5
Rail Facility & Improvements (6.4)		.500	10.5				11.0
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (6.4)			.250				.250
Subtotal Direct Costs	5.40	7.67	15.7				28.7
Contractor's Overhead & Profit @ 15%	.81	1.15	2.36				4.32
Subtotal	6.21	8.82	18.1				33.1
Contingency @ 15%	.93	1.32	2.71				4.96
Subtotal	7.14	10.1	20.8				38.0
Engineering & Design, Supervision & Adm. @ 15%	1.17	1.52	3.12				5.81
Subtotal	8.21	11.6	23.9				43.7
Land (6.4)			2.43				2.43
TOTAL NAVIGATION COSTS	8.21	11.6	26.3				46.1

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.25
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 12 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.60						2.60
Bank Cuts & Deepening (2.4, 3.4)	2.80	.533					3.33
Building Demolition							
Conveyors (6.5)		6.64	4.57				11.2
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway (6.5)		.451	15.5				16.0
Tunnel							
Utilities (6.5)			.250				.250
Subtotal Direct Costs	5.40	7.62	20.3				33.3
Contractor's Overhead & Profit @ 15%	0.81	1.14	3.05				5.00
Subtotal	6.21	8.76	23.4				38.4
Contingency @ 15%	0.93	1.31	3.51				5.75
Subtotal	7.14	10.1	26.9				44.1
Engineering & Design, Supervision & Adm. @ 15%	1.07	1.52	4.04				6.63
Subtotal	8.21	11.6	30.9				50.7
Land (6.5)			3.14				3.14
TOTAL NAVIGATION COSTS	8.21	11.6	34.0				53.8

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.26
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 12 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.4)*	2.60						2.6
Bank Cuts & Deepening (2.4, 3.5)	2.80	.533					3.33
Building Demolition							
Conveyors (6.5)		6.64	4.90				11.5
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway (6.5)		.50	15.5				16.0
Tunnel							
Utilities (6.5)			.250				.250
Subtotal Direct Costs	5.4	7.67	20.6				33.7
Contractor's Overhead & Profit @ 15%	.81	1.15	3.09				5.06
Subtotal	6.21	8.82	23.7				38.7
Contingency @ 15%	.93	1.32	3.55				5.80
Subtotal	7.14	10.1	27.2				44.4
Engineering & Design, Supervision & Adm. @ 15%	1.07	1.51	4.08				6.66
Subtotal	8.21	11.6	31.3				51.1
Land (6.5)			3.14				3.14
TOTAL NAVIGATION COSTS	8.21	11.56	34.4				54.2

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.27
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 13 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.90						3.90
Bank Cuts & Deepening (2.6, 3.4)	2.90	8.1					11.0
Building Demolition (3.4)		1.00					1.00
Conveyors (6.2)		7.09	22.3				29.4
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 6.2)		1.01	.250				1.26
Subtotal Direct Costs	6.80	17.2	22.6				46.6
Contractor's Overhead & Profit @ 15%	1.02	2.58	3.39				6.99
Subtotal	7.82	19.8	26.0				53.6
Contingency @ 15%	1.17	2.97	3.90				8.04
Subtotal	8.99	22.8	29.9				61.7
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.42	4.49				9.26
Subtotal	10.3	26.2	34.4				70.9
Land (3.4, 6.2)		.954	1.16				2.11
TOTAL NAVIGATION COSTS	10.3	27.2	35.6				73.1

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.28
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 13 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.90						3.90
Bank Cuts & Deepening (2.6, 3.4)	2.90	9.37					12.3
Building Demolition (3.5)		1.57					1.57
Conveyors (6.2)		7.09	22.7				29.8
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5, 6.2)		1.02	.25				1.27
Subtotal Direct Costs	6.80	19.1	23.0				48.9
Contractor's Overhead & Profit @ 15%	1.02	2.86	3.45				7.33
Subtotal	7.82	22.0	26.5				56.3
Contingency @ 15%	1.17	3.3	3.97				8.44
Subtotal	8.99	25.3	30.5				64.8
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.79	4.57				9.71
Subtotal	10.3	29.1	35.1				74.5
Land (3.5, 6.2)		1.09	1.16				2.25
TOTAL NAVIGATION COSTS	10.3	30.2	36.3				76.8

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.29
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 16 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.90						3.90
Bank Cuts & Deepening (2.6, 3.4)	2.90	8.1					11.0
Building Demolition (3.4)		1.00					1.00
Conveyors (6.3)		6.64	7.94				14.6
Rail Facility & Improvements							
Special Purpose Vessel & Facility (6.3)			33.0				33.0
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 6.3)		1.01	.250				1.26
Subtotal Direct Costs	6.80	16.8	41.2				64.8
Contractor's Overhead & Profit @ 15%	1.02	2.52	6.18				9.72
Subtotal	7.82	19.3	47.4				74.5
Contingency @ 15%	1.17	2.90	7.11				11.2
Subtotal	8.99	22.2	54.5				85.7
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.33	8.18				12.9
Subtotal	10.3	25.5	62.7				98.5
Land (3.4, 6.3)		.954	1.97				2.92
TOTAL NAVIGATION COSTS	10.3	26.5	64.7				101.4

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.30
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 14 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							3.90
Breakwaters (2.6)*	3.90						12.2
Bank Cuts & Deepening (2.6, 3.5)	2.90	9.37					1.6
Building Demolition (3.5)		1.57					15.23
Conveyors (6.3)		6.64	8.6				
Rail Facility & Improvements							33.1
Special Purpose Vessel & Facility (6.3)			33.2				
Truck Transfer Facility & Roadway							
Tunnel							1.4
Utilities (3.5, 6.3)		1.02	.25				67.4
Subtotal Direct Costs	6.80	18.6	42.0				10.1
Contractor's Overhead & Profit @ 15%	1.02	2.79	6.3				77.5
Subtotal	7.82	21.4	48.3				11.63
Contingency @ 15%	1.17	3.21	7.25				89.1
Subtotal	8.99	24.6	55.5				13.37
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.69	8.33				102.5
Subtotal	10.3	28.3	63.8				3.09
Land (3.5, 6.3)		1.09	2.0				106.0
TOTAL NAVIGATION COSTS	10.3	29.4	65.8				

*( ) Indicates Table in previous section(s) detailing these costs.

TABLE 7.31
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 15 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions) Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.90						3.90
Bank Cuts & Deepening(2.6, 3.4)	2.90	8.10					11.0
Building Demolition (3.4)		1.00					1.00
Conveyors (6.4)		6.64	4.57				11.2
Rail Facility & Improvements (6.4)		.451	10.5				11.0
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.4, 6.4)		1.01	.250				1.26
Subtotal Direct Costs	6.80	17.2	15.3				39.3
Contractor's Overhead & Profit @ 15%	1.02	2.58	2.30				5.9
Subtotal	7.82	19.8	17.6				45.2
Contingency @ 15%	1.17	2.97	2.64				6.78
Subtotal	[illegible].99	22.8	20.2				52.1
Engineering & Design, Supervision & Adm. @ 15%	[illegible]35	3.42	3.03				7.8
Subtotal	10.34	26.2	23.2				59.7
Land (3.4, 6.4)		.954	1.97				2.92
TOTAL NAVIGATION COSTS	10.34	27.1	25.2				62.6

*( ) Indicates Tables in previous section(s) detailing these costs.

TABLE 7.32
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 15 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.90						3.9
Bank Cuts & Deepening (2.6, 3.5)	2.90	9.37					12.3
Building Demolition (3.5)		1.57					1.57
Conveyors (6.4)		6.6	4.9				11.5
Rail Facility & Improvements (6.4)		.451	10.5				11.0
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway							
Tunnel							
Utilities (3.5, 6.4)		1.02	25				1.27
Subtotal Direct Costs	6.80	19.0	15.7				41.5
Contractor's Overhead & Profit @ 15%	1.02	2.85	2.35				6.22
Subtotal	7.82	21.9	18.0				47.7
Contingency @ 15%	1.17	3.29	2.70				7.16
Subtotal	8.99	25.2	20.7				45.9
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.78	3.10				8.23
Subtotal	10.3	29.0	23.8				63.1
Land (3.5, 6.4)		1.09	1.97				3.06
TOTAL NAVIGATION COSTS	10.3	30.0	25.8				66.1

*( )Indicates Tables in previous section(s) these costs.

TABLE 7.33
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 16 OPTION 1 (1,000 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.90						3.90
Bank Cuts & Deepening (2.6, 3.4)	2.90	8.10					11.0
Building Demolition (3.4)		1.00					1.00
Conveyors (6.5)		6.64	4.57				11.2
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway (6.5)		.451	15.5				15.9
Tunnel							
Utilities (3.4, 6.5)		1.01	.250				1.26
Subtotal Direct Costs	6.80	16.2	20.3				43.3
Contractor's Overhead & Profit @ 15%	1.02	2.43	3.04				6.49
Subtotal	7.82	18.6	23.3				49.7
Contingency @ 15%	1.17	2.79	3.49				7.45
Subtotal	8.99	21.4	26.8				57.2
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.21	4.02				8.58
Subtotal	10.3	24.6	30.8				65.7
Land (3.4, 6.5)		9.54	2.67				12.2
TOTAL NAVIGATION COSTS	10.3	34.1	33.5				77.9

*( ) Indicates Tables in previous section(s) detailing these costs.

TABLE 7.34
ESTIMATE OF NAVIGATION PROJECT COSTS
ALTERNATIVE 16 OPTION 2 (1,200 - FOOT VESSELS)
(1979 Dollars)

ITEM	Costs (in millions)						
	Outer Harbor	Mouth of Black River to Amship	Amship to Lower Turning Basin	Lower Turning Basin to Upper Turning Basin	Federal Costs	Local Costs	Total Costs
Bridges							
Breakwaters (2.6)*	3.9						3.9
Bank Cuts & Deepening (2.6, 3.5)	2.9	8.931					11.9
Building Demolition (3.5)		1.57					1.57
Conveyors (6.5)		6.6	4.90				11.5
Rail Facility & Improvements							
Special Purpose Vessel & Facility							
Truck Transfer Facility & Roadway (6.5)		.5	15.6				16.1
Tunnel							
Utilities (3.5, 6.5)		1.02	.25				1.27
Subtotal Direct Costs	6.80	18.6	20.8				46.2
Contractor's Overhead & Profit @ 15%	1.02	2.79	3.12				6.93
Subtotal	7.82	21.4	23.9				53.1
Contingency @ 15%	1.17	3.21	3.6				7.98
Subtotal	8.99	24.6	27.5				61.1
Engineering & Design, Supervision & Adm. @ 15%	1.35	3.69	4.12				9.16
Subtotal	10.3	28.3	31.60				70.2
Land (3.5, 6.5)		1.09	2.43				3.52
TOTAL NAVIGATION COSTS	10.3	26.77	34.0				73.7

*( ) Indicates Tables in previous section(s) detailing these costs.

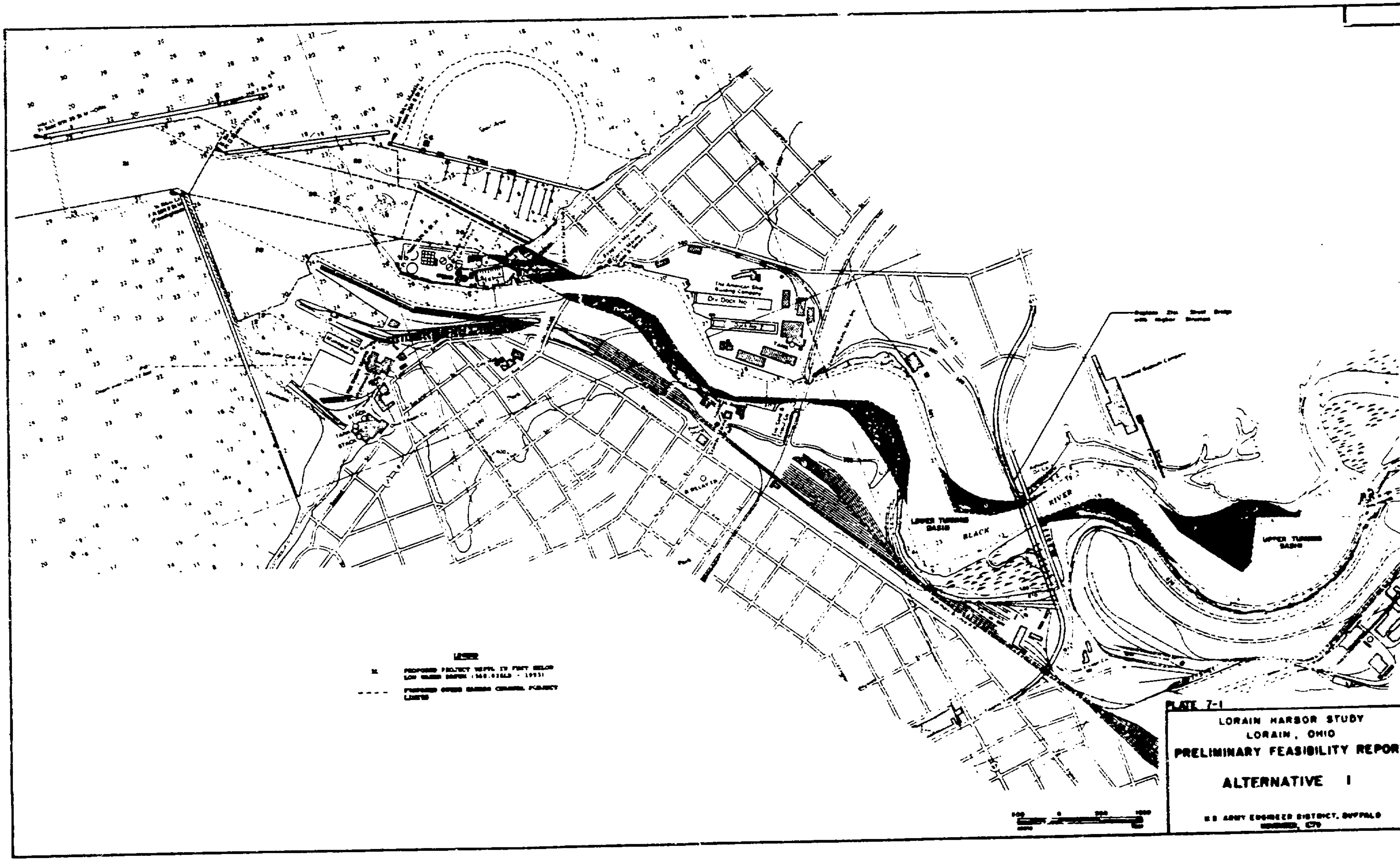
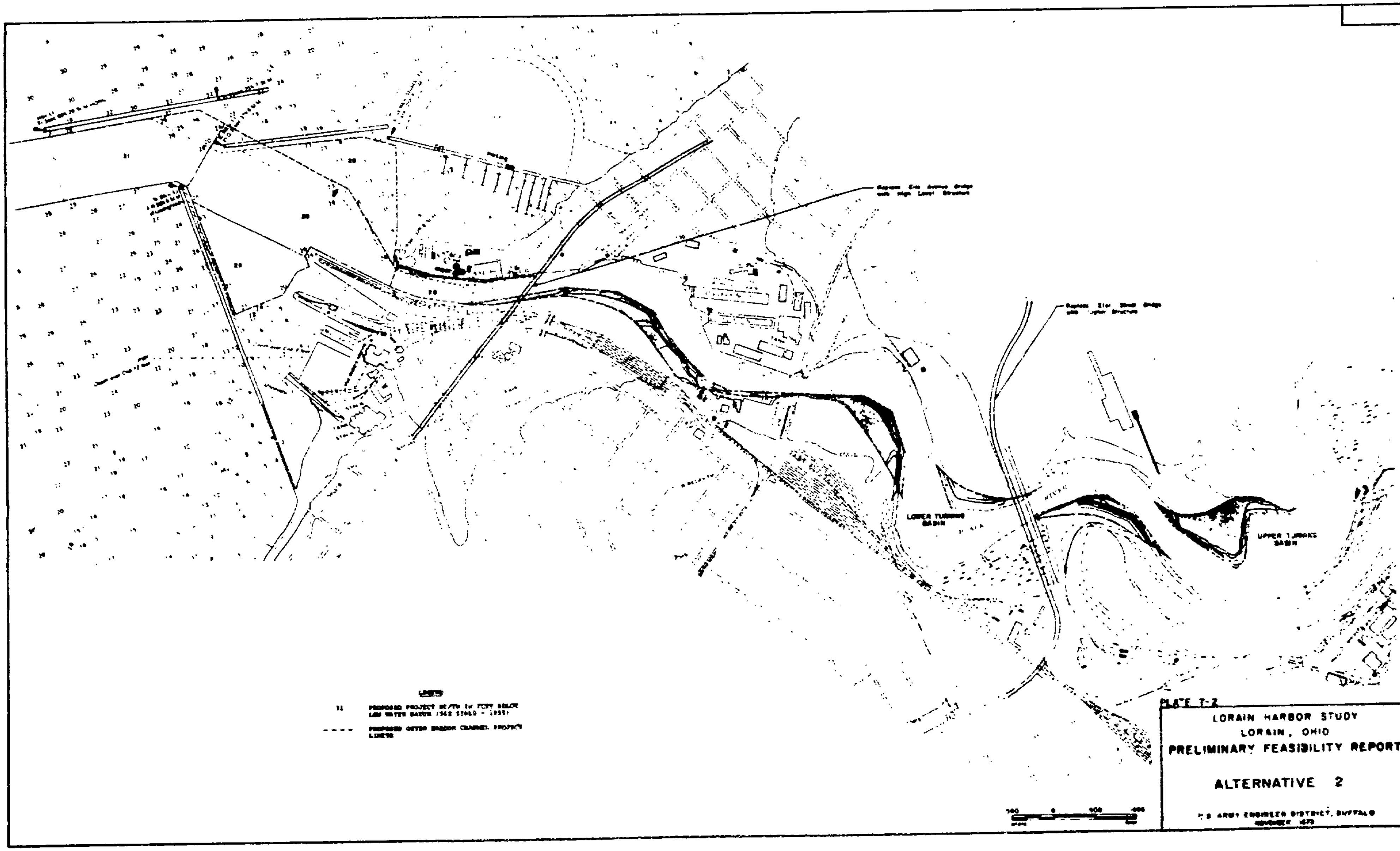
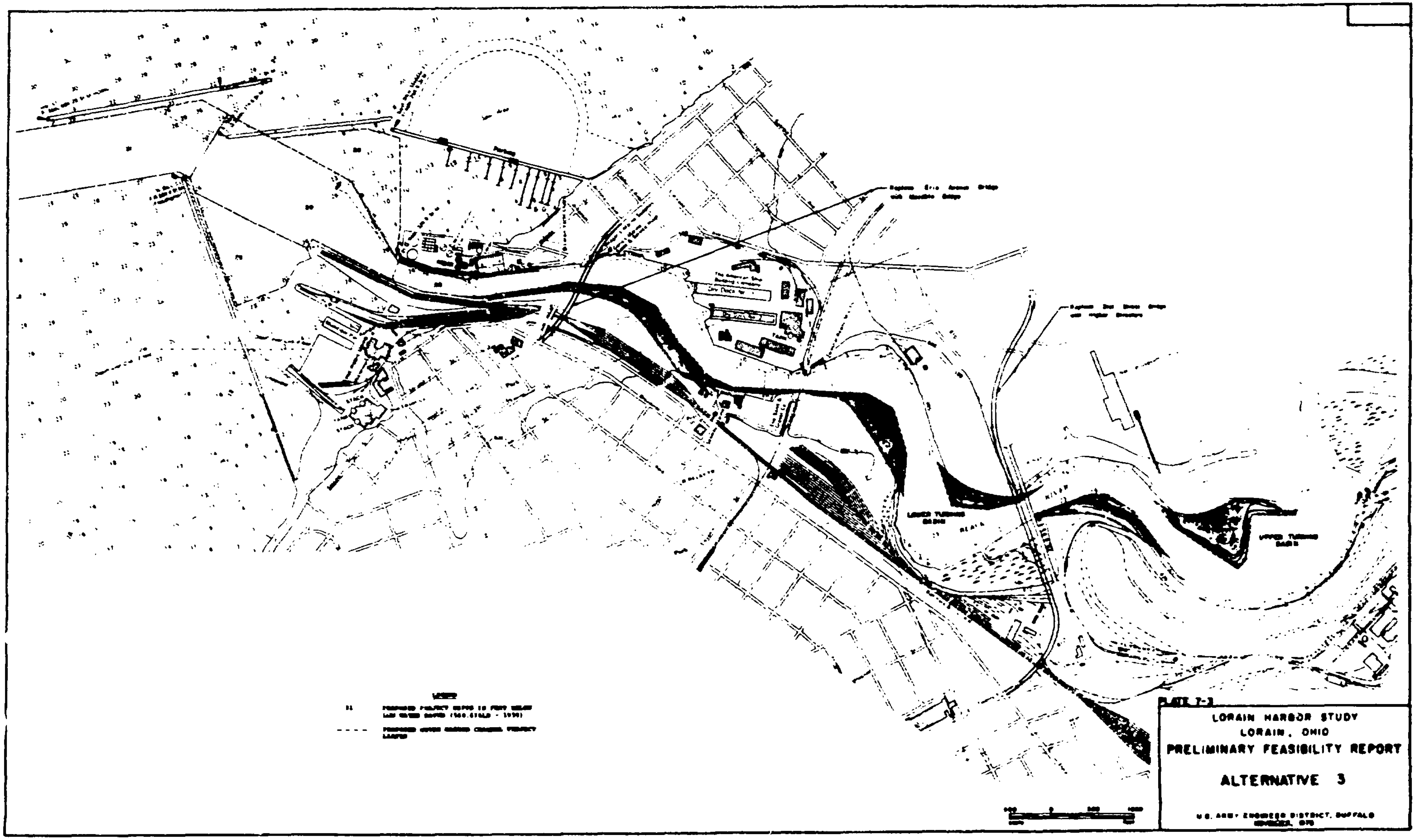
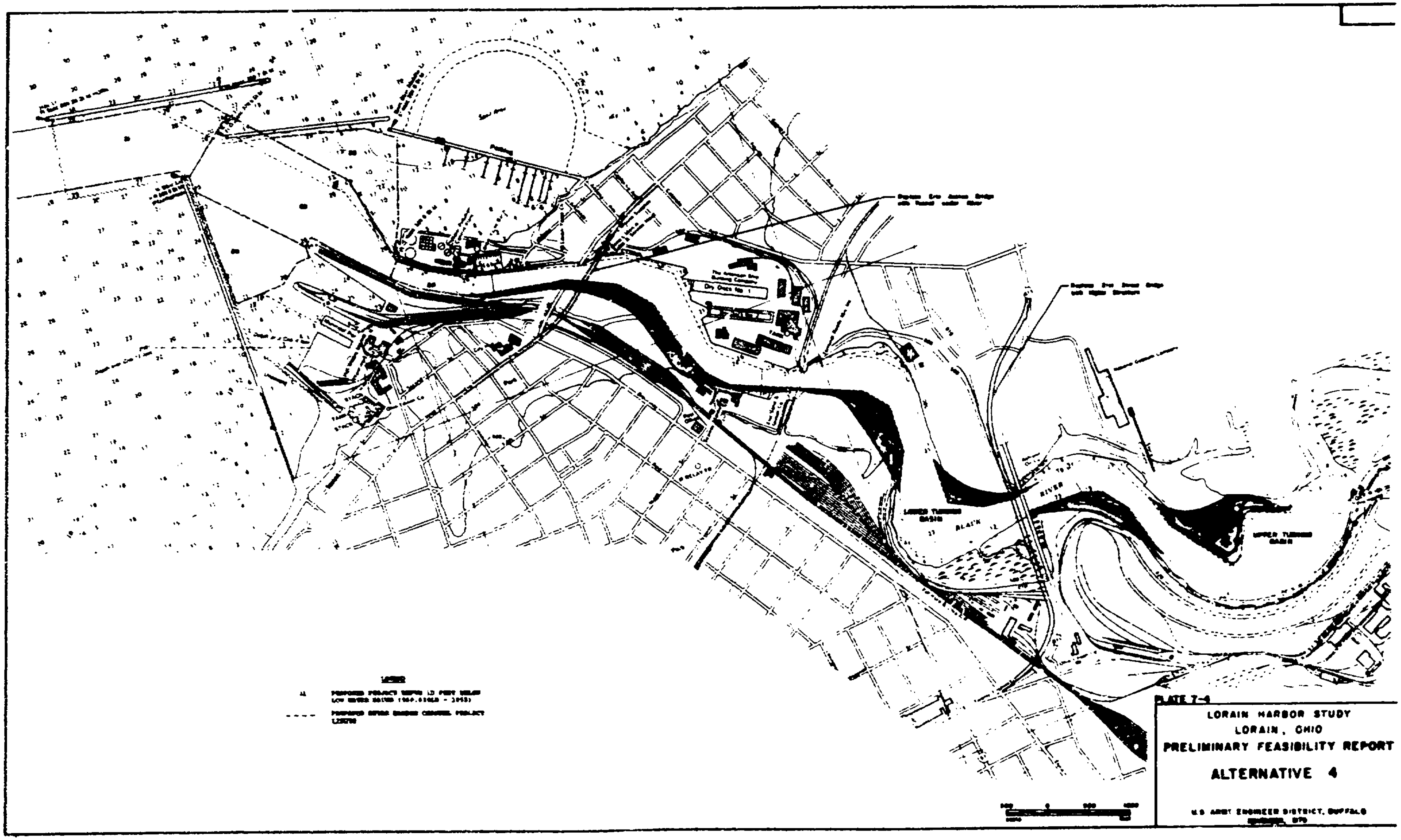


PLATE 7-1
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE I
U.S. ARMY ENGINEER DISTRICT, BUFFALO
LOWER TURNING BASIN
UPPER TURNING BASIN
BLACK
RIVER
The American Ship Building Company
Dry Dock No 1


LOWER TURNING BASIN
UPPER TURNING BASIN
PLATE 7-2
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 2
U.S. ARMY ENGINEER DISTRICT, BUFFALO


LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 3
U.S. ARMY ENGINEER DISTRICT, BUFFALO


LOWER TURNING BASIN
UPPER TURNING BASIN
BLACK
RIVER
Dry Dock No. 1
PLATE 7-4
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 4
U.S. ARMY ENGINEER DISTRICT, BUFFALO

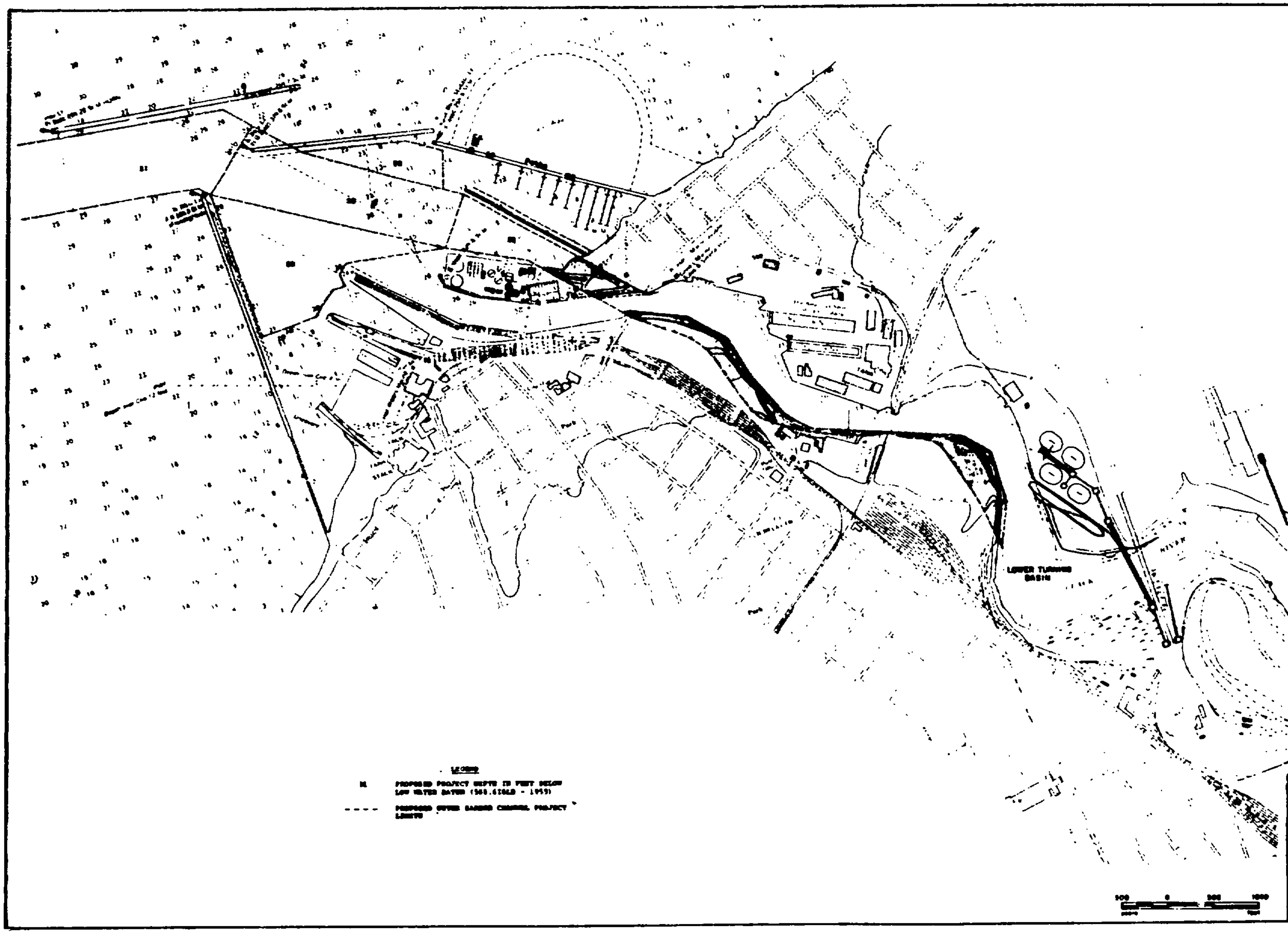


PLATE 7-5

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 5

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979

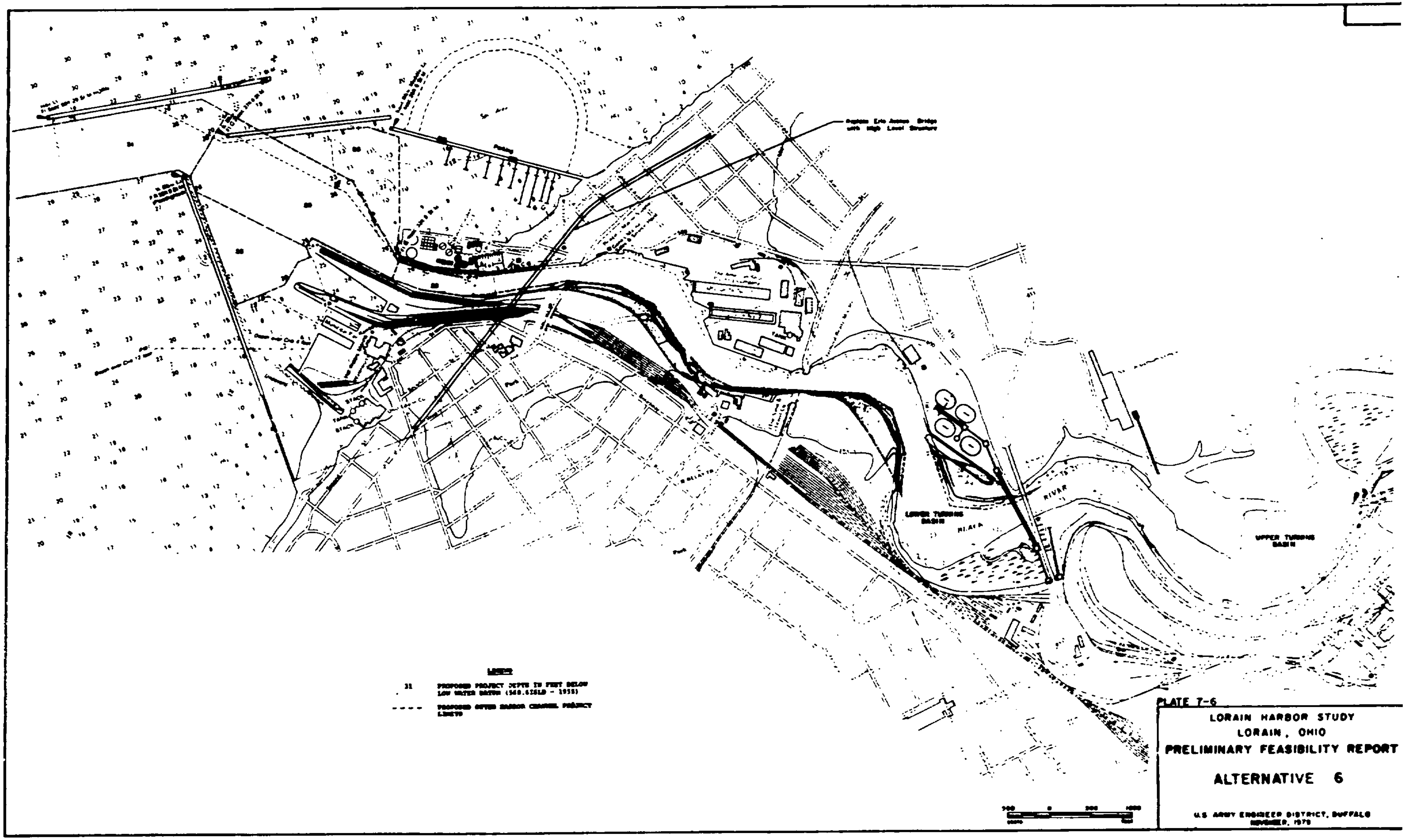


PLATE 7-6

LORAIN HARBOR STUDY

LORAIN, OHIO

PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 6

U.S. ARMY ENGINEER DISTRICT, BUFFALO

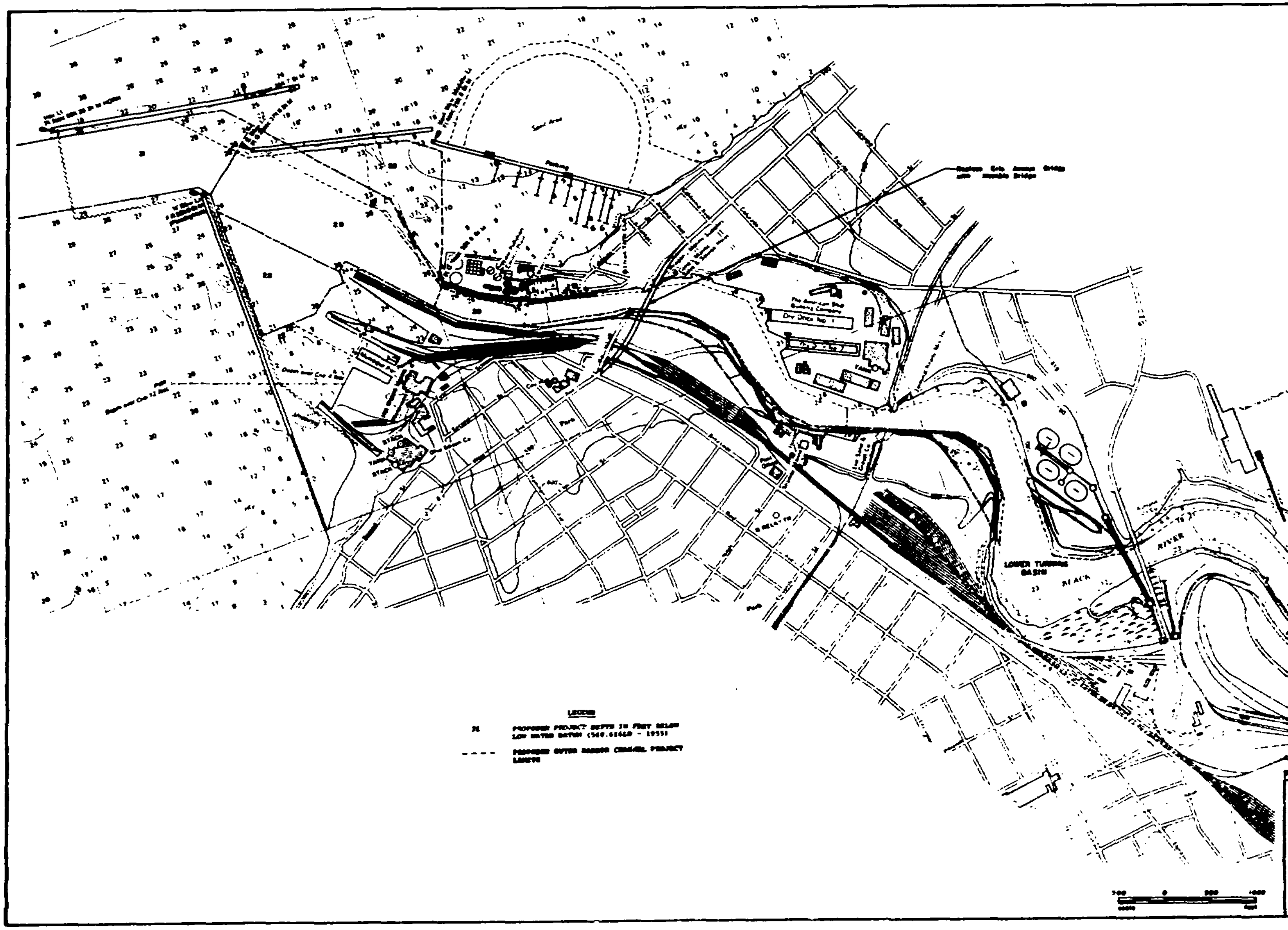
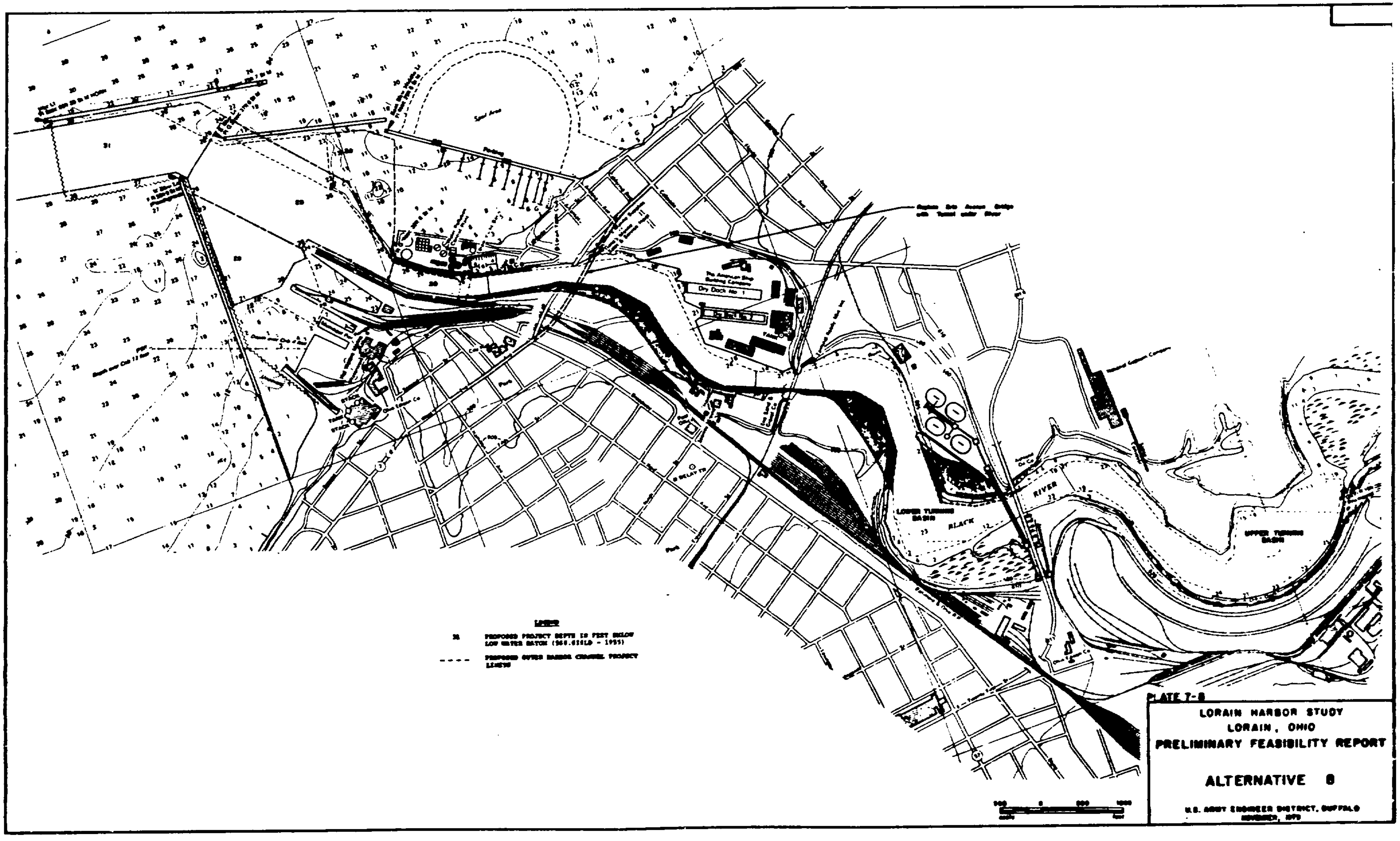


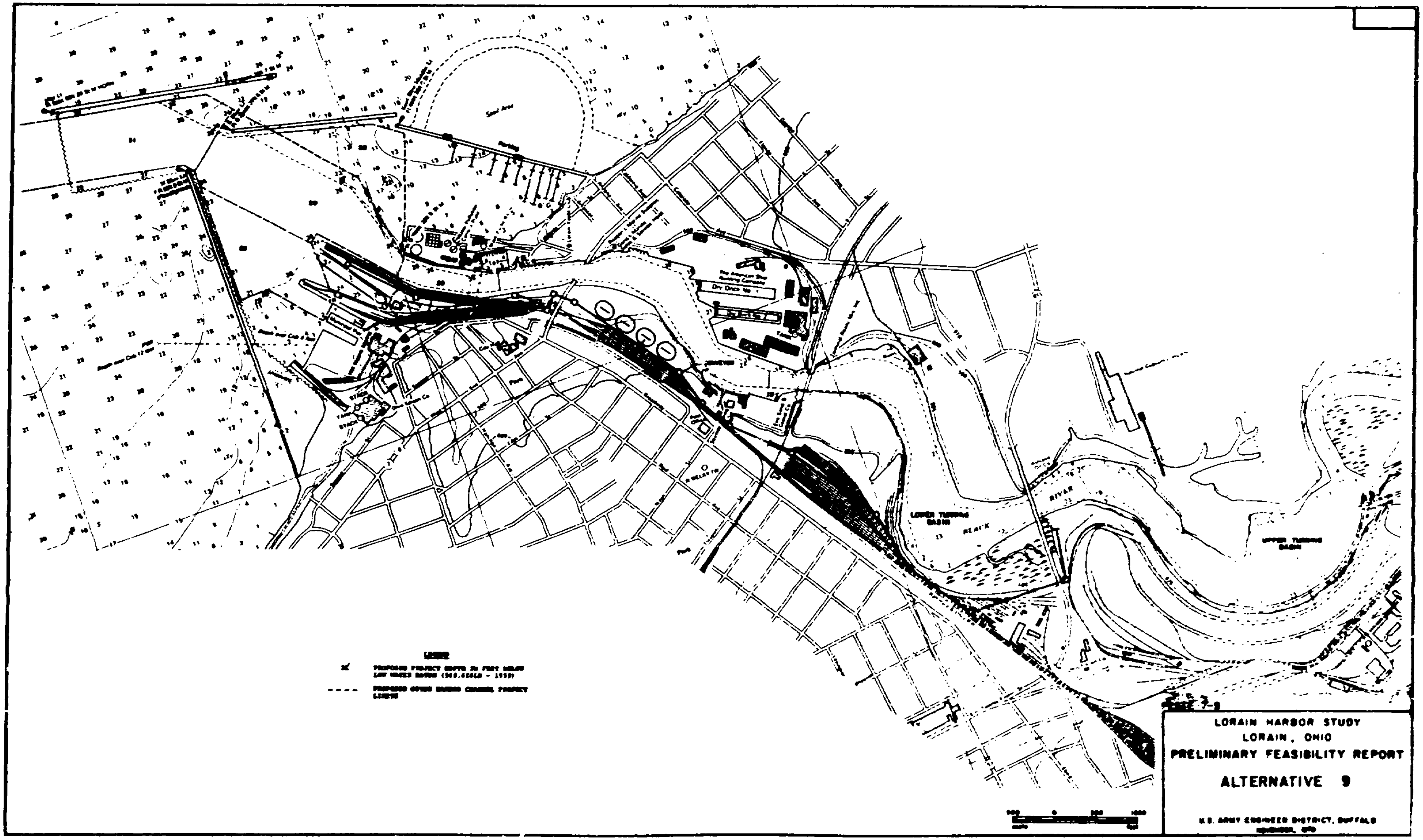
PLATE 7-7

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 7

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979


Dry Dock No. 1
BLACK
RIVER
PLATE 7-8
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 8
U.S. ARMY ENGINEER DISTRICT, BUFFALO



LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 9
U.S. ARMY ENGINEER DISTRICT, BUFFALO
The American Ship Building Company
Dry Dock No. 1
LOWER TURNING BASIN
UPPER TURNING BASIN
RIVER

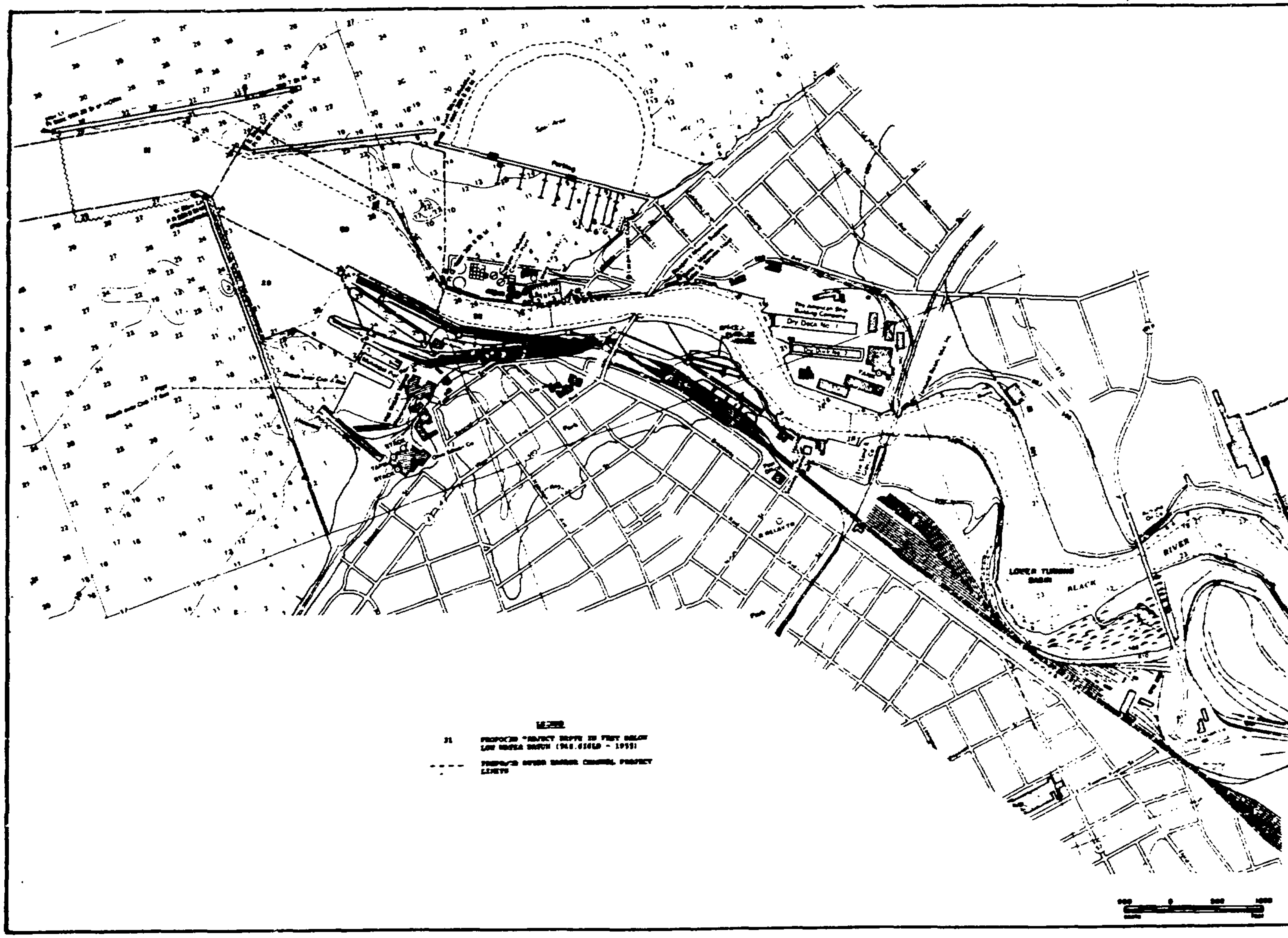


PLATE 7-10

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 10

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979

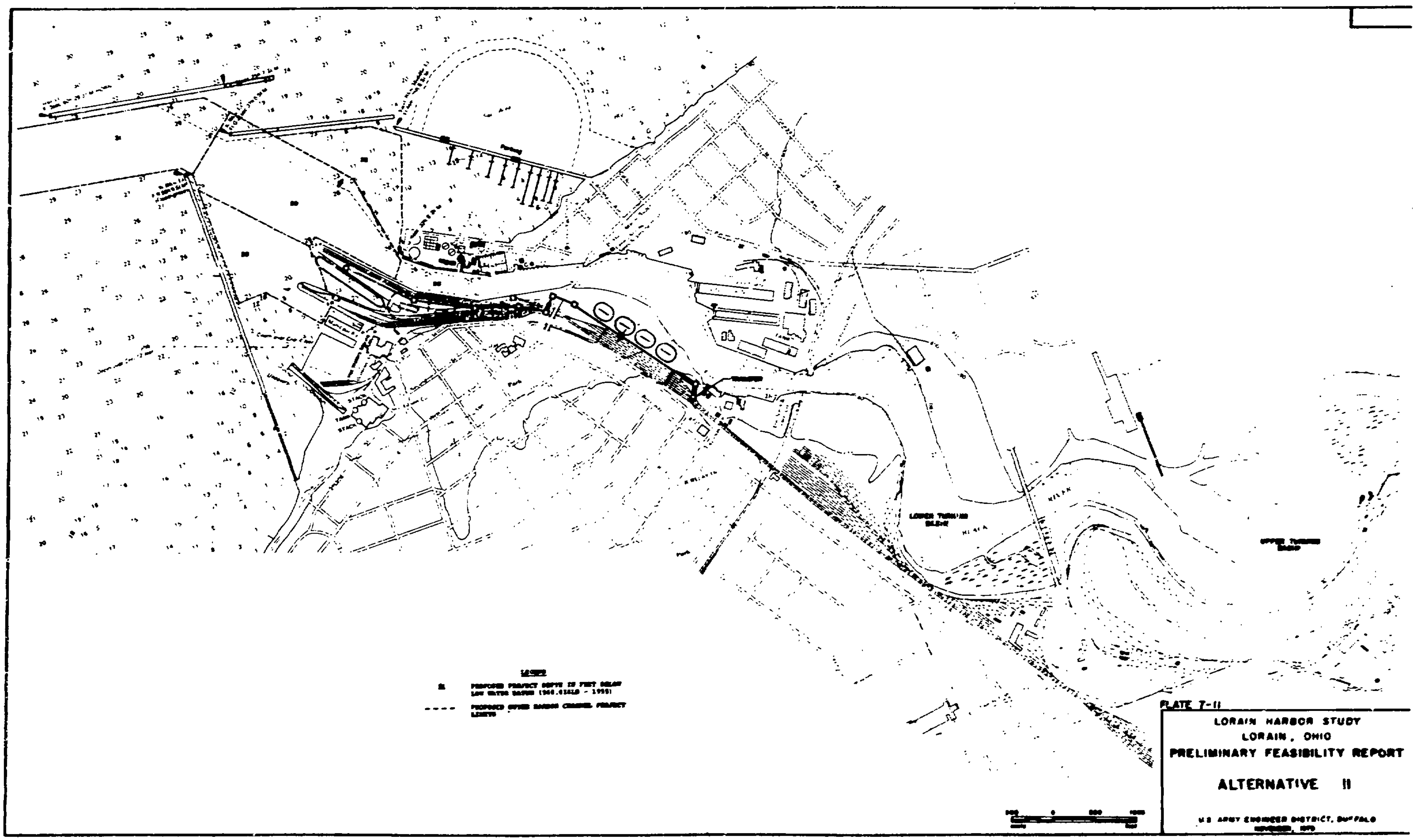


PLATE 7-11

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE II

U.S. ARMY ENGINEER DISTRICT, BUFFALO

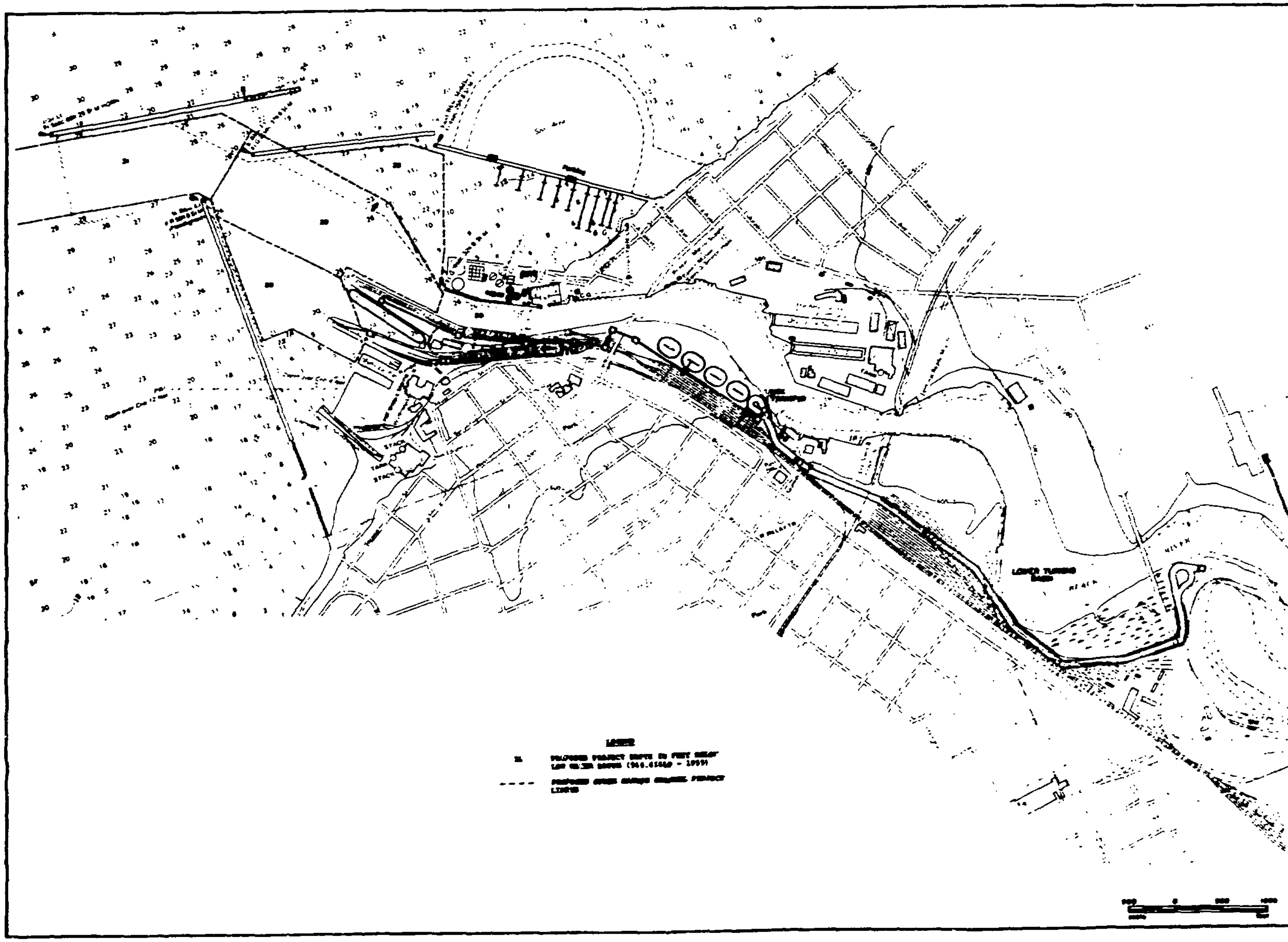


PLATE 7-12

LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 12

U.S. ARMY ENGINEER DISTRICT, BUFFALO

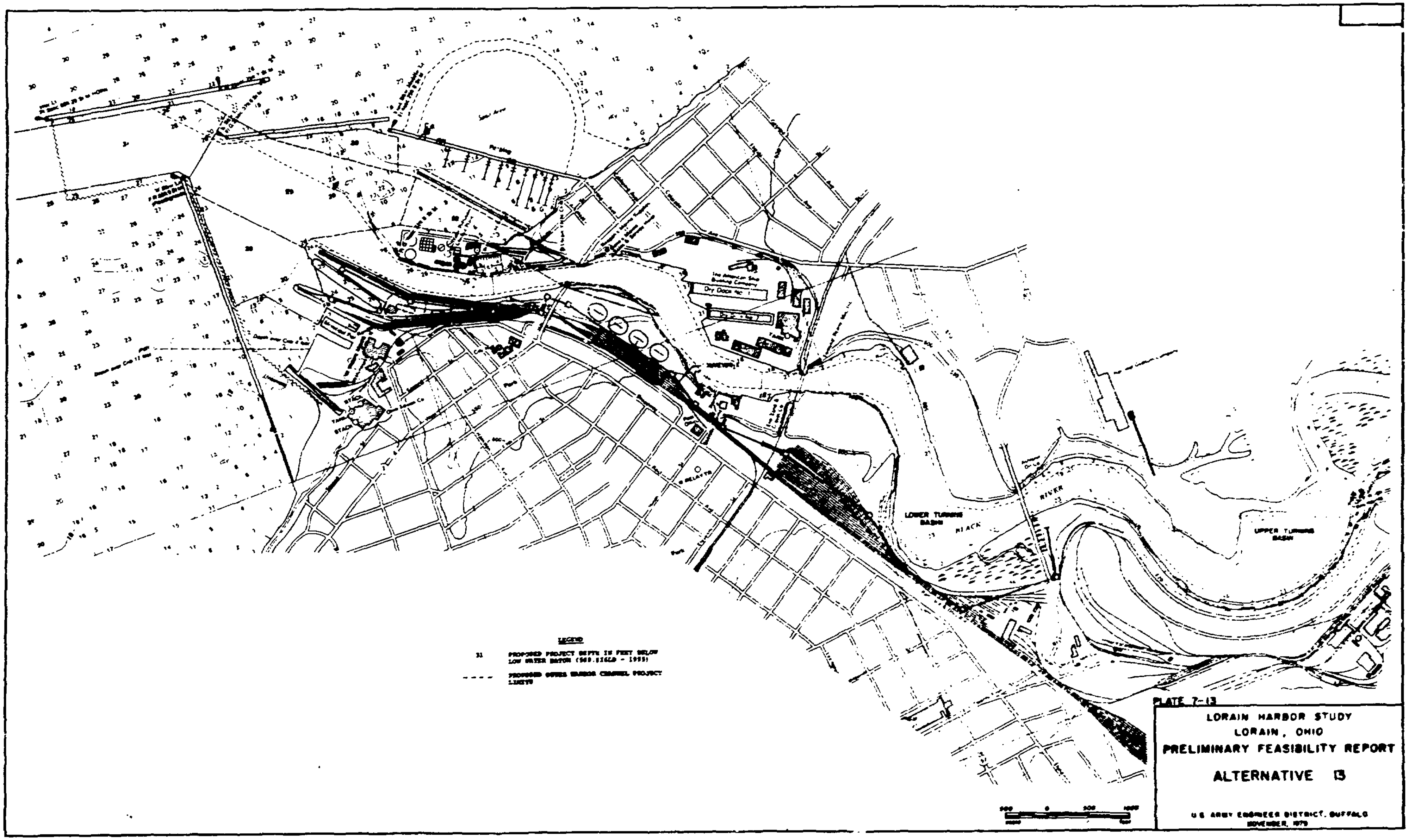
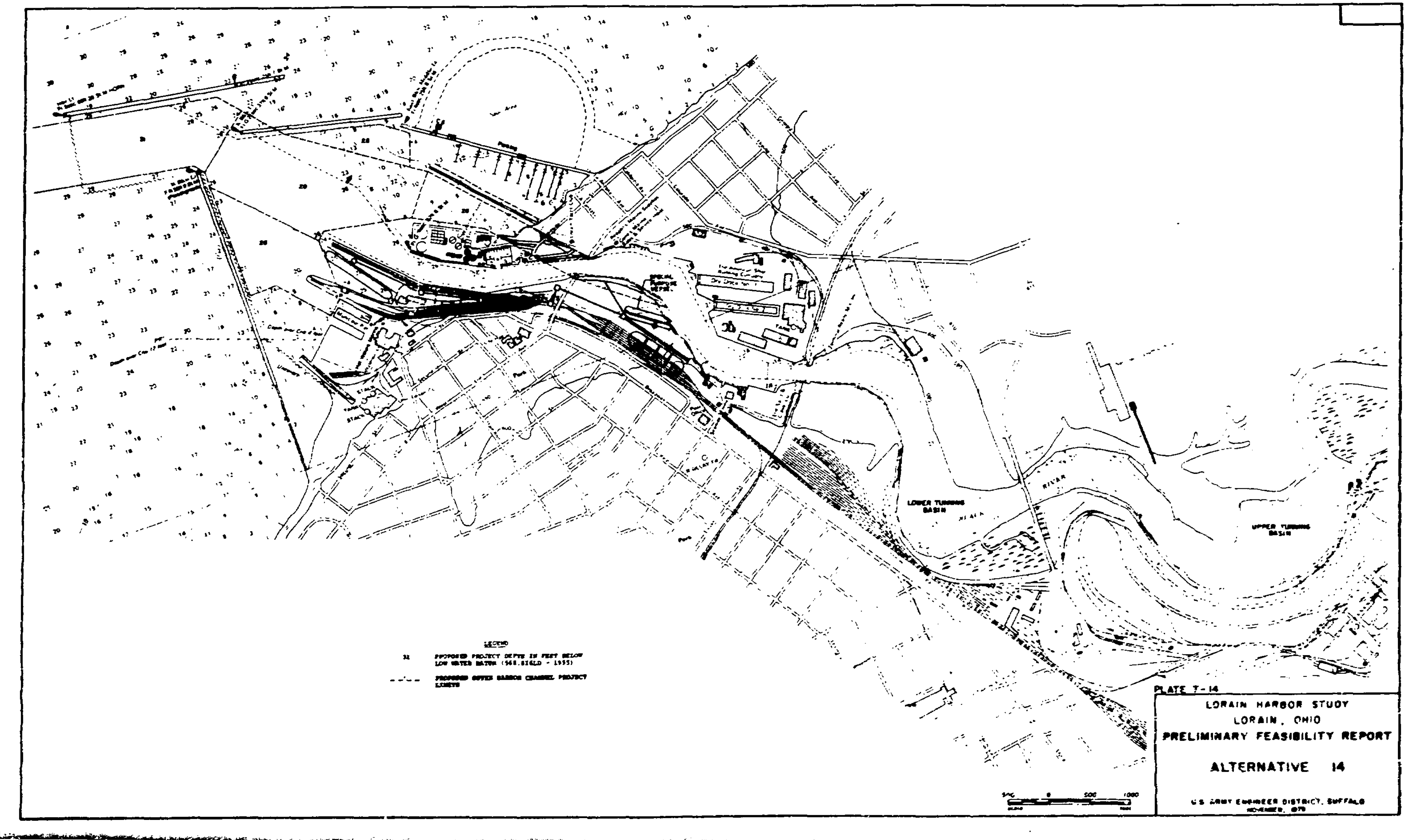


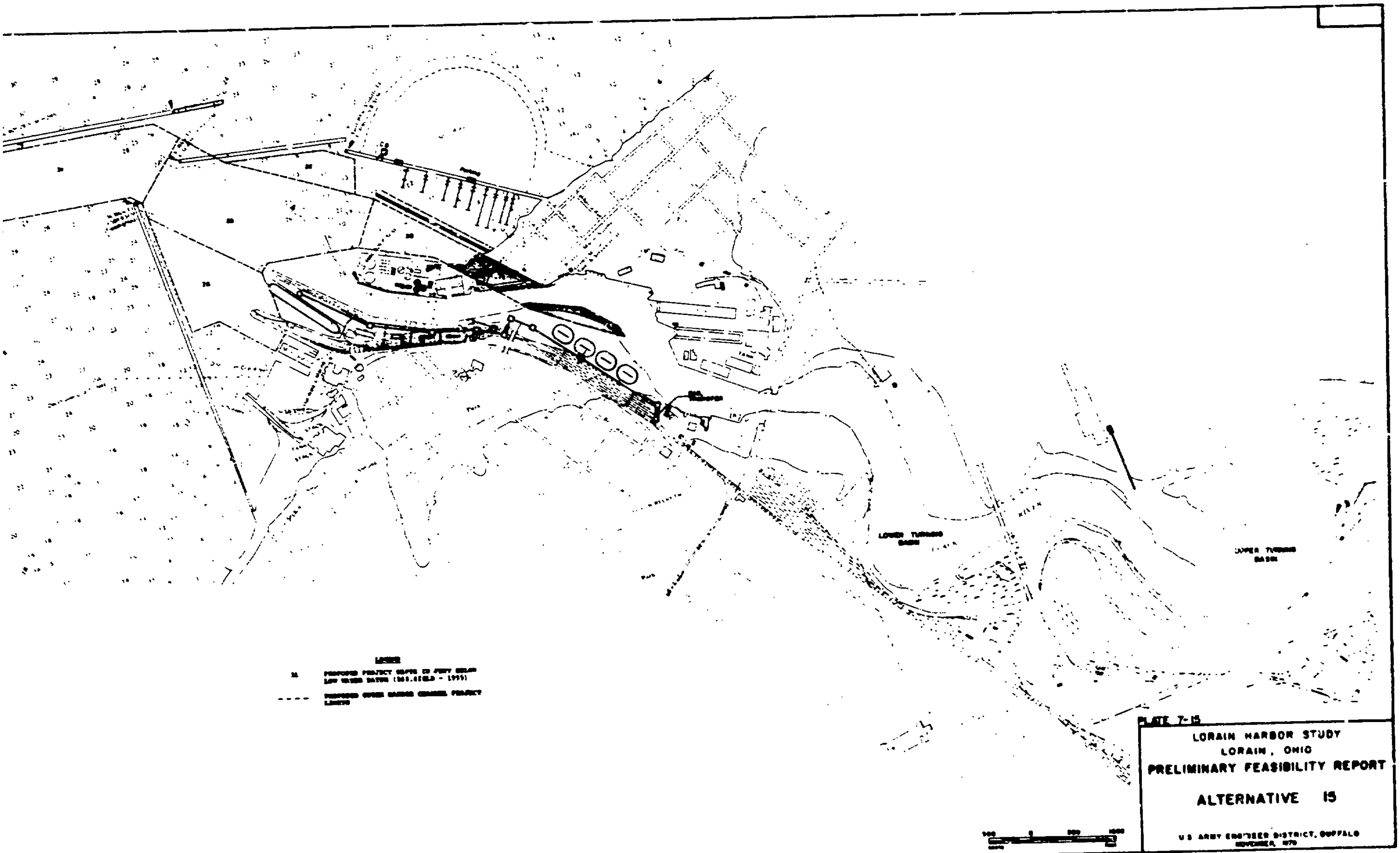
PLATE 7-13

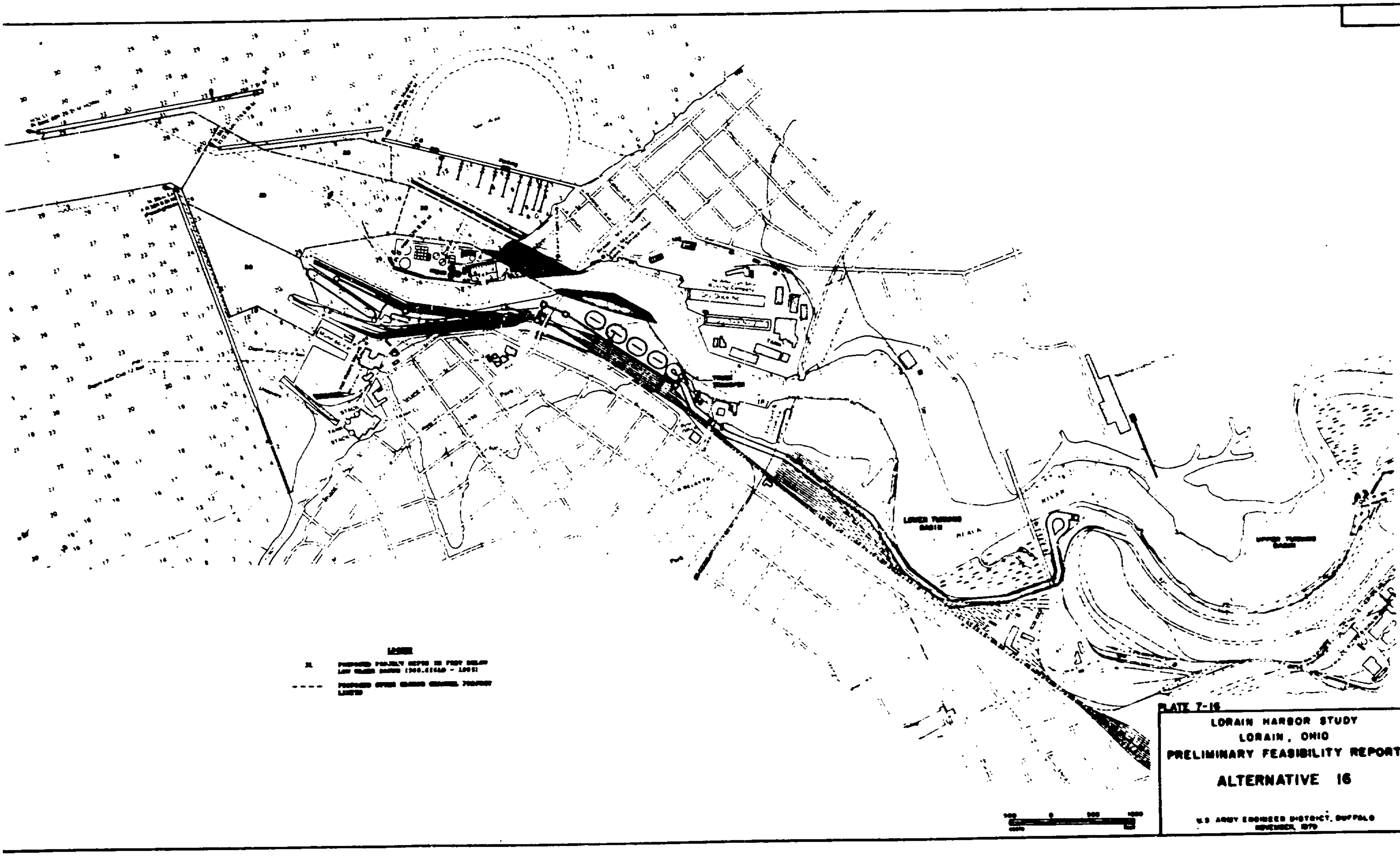
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 13

U.S. ARMY ENGINEER DISTRICT, BUFFALO
NOVEMBER, 1979


LOWER TURNING BASIN
UPPER TURNING BASIN
RIVER
SPECIAL PURPOSE DEPTH
LEGEND
PROPOSED PROJECT DEPTH IN FEET BELOW LOW WATER DATUM (568.6IGLD - 1955)
PROPOSED OUTER HARBOR CHANNEL PROJECT LIMITS
PLATE 7-14
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 14
U.S. ARMY ENGINEER DISTRICT, BUFFALO


LOWER TURNING BASIN
UPPER TURNING BASIN
PLATE 7-15
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 15
U.S. ARMY ENGINEER DISTRICT, BUFFALO


LEGEND
LOWER TURNING BASIN
UPPER TURNING BASIN
PLATE 7-16
LORAIN HARBOR STUDY
LORAIN, OHIO
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 16

EXPLANATION OF ATTACHMENT 1

The following work sheets refer to detail construction items, quantities, units, unit prices and costs associated with Lakefront or Upriver transshipment construction items. Estimates are separated by Alternatives, Options and geographic location.

Estimates by Alternative are as follows:

ALTERNATIVE NUMBER	DESCRIPTION
5, 6, 7 & 8	Transshipment facility below 21st Street with transfer to conveyor upriver from 21st Street.
9 & 13	Lakefront transshipment facility with transfer to Upriver conveyor system.
10	Lakefront transshipment facility with transfer to Upriver special purpose vessel.
11 & 15	Lakefront transshipment facility with transfer to Upriver rail system.
12 & 16	Lakefront transshipment facility with transfer to Upriver truck system.
14	Lakefront transshipment facility with transfer to Upriver special purpose vessel when a new channel through Riverside Park is constructed.

Estimates by options are directed as follows:

OPTION NUMBER	DESCRIPTION
1	Navigation capabilities up to 1000 foot vessels
2	Navigation capabilities up to 1200 foot vessels

Estimate with a * indicates that the item and cost falls a location between the mouth of the Black River and American Shipbuilding. All other items are located between American Shipbuilding and the Lower Turning Basin.

ALTERNATIVE 5, 6, 7, & 8 OPTION 1 PAGE 1 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUT & DEEPENING				
1.	DREDGING	NONE	—	—	—
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	15	ACRE	4,000	60,000
2.	EARTHWORK (CUT & OFFSITE SPOIL)	122,250	CY	7	855,750
3.	ACCESS ROAD	3425	SY	12	41,100
4.					
					(956,850)
C.	WHARF CONSTRUCTION				
1.	WHARF (STEEL SHEET PILING)	89,600	SF	13.50	1,209,600
2.	REIN. CONC. ANCHORS	760	CY	150	114,000
3.	TIE RODS, 2½" ϕ	9600	LF	3	28,800
4.	REIN. CONC. DECK CAP	570	CY	150	85,500
5.	TIMBER FENDER SYSTEM	1000	LF	32.50	32,500
6.	MOORING DEVICES	20	EA	850	17,000
7.	ANCHOR PILES	2600	LF	9	23,400
					(1,510,800)
D.	MATERIAL HANDLING SYSTEM				
1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	248,000	496,000
4.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
5.					(2,871,000)
6.					

ALTERNATIVE 5, 6, 7, & 8 OPTION 1

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
7.					
8.					
9.					
10.					
	TRANSSHIPMENT SUBTOTAL (B+C+D)				5,338,650
E.	CONVEYOR SYSTEM				
1.	CONVEYOR	4000	LF	2250	9,000,000
2.	CONVEYOR BRIDGE	LUMP	SUM	1,500,000	1,500,000
3.	BRIDGE PILING SUPPORTS	300	LF	9	2,700
4.	SPREAD FOOTING CONVEYOR SUPPORTS THRU SWAMP	75	CY	150	11,250
5.	EARTHWORK	6300	CY	5	31,500
	CONVEYOR SYS. SUBTOTAL				(10,545,450)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	SUBTOTAL DIRECT COSTS				16,134,100

ALTERNATIVE 9 & 13 OPTION 1 PAGE 1 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13^{90}	533,065
B.	SITE DEVELOPMENT				
1.	CLEARING & GRUBBING	9.64	ACRE	1000	9,640
2.	GRADING	46,700	SY	3	140,100
3.	EARTHWORK	133,000	CY	5	665,000
					(819,740)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP. DECK	490	CY	150	73,500
★ 2.	TIMBER FENDERING SYSTEM	1100	LF	32^{50}	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
★ 1.	DOCK/HOPPER	1	EA	325,000	325,000
2.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
3.	STACKER/RECLAIMER	1	EA	2,000,000	2,000,000
4.	DOZERS	2	EA	248,000	496,000
					(2,871,000)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				3,811,490
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2,770	LF	2250	6,232,500
1.	CONVEYOR	8,430	LF	2250	18,967,500
★ 2.	CONVEYOR ENCLOSURE (THRU REPUB.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000

ALTERNATIVE 9 & 13 OPTION ______

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
4.	BRIDGE (N & W R.R.)	LUMP	SUM		
5.	BRIDGE (E. 9TH ST.)	LUMP	SUM	INCLUDED	IN ITEM E-1
6.	CONVEYOR HOUSING		LF		
	CONVEYOR SYS. SUBTOTAL				(25,605,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				22,578,240
	SUBTOTAL DIRECT COSTS				30,200,055

ALTERNATIVE 10 OPTION 1

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13 90	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	17.45	ACRE	4,000	69,800
2.	EARTHWORK (CUT & OFFSET SPOIL)	293,500	CY	7	2,054,500
3.	ACCESS ROAD	4,045	SY	12	48,540
4.	RAIL REMOVAL	6500	LF	6	39,000
					(2,211,840)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	32 50	35,750
★ 3	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
★ 1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	248,000	496,000
4.	SHIPLOADER	1	EA	1,850,000	1,850,000
5.	REIN. CONC. BIN WALLS	18,600	SF	15	279,000
6.	SPECIAL PURPOSE VESSEL	1	EA	25,000,000	25,000,000
7.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
					(30,000,000)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				32,338,090

ALTERNATIVE 10- OPTION 1 PAGE 2 OF 2

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2,770	LF	2,250	6,232,500
1.	CONVEYOR	3,530	LF	2,250	7,942,500
★ 2.	CONVEYOR ENCLOSURE (THRU REPUB.)	1,500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(14,580,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
G.	SPECIAL PURPOSE VESSEL LOADING FACILITY				
1.	WHARF (SHEET STEEL PILING)	91,000	SF	13.50	1,228,500
2.	REIN. CONC. ANCHORS	770	CY	150	115,500
3.	TIE RODS, 2½" ϕ	9750	LF	3	29,250
4.	REIN. CONC. DECK CAP	360	CY	150	54,000
5.	TIMBER FENDER SYSTEM	700	LF	32.50	22,750
6.	MOORING DEVICES	12	EA	850	10,200
7.	ANCHOR PILES	2600	LF	9	23,400
	SPV LOADING FAC. SUBTOTAL				(1,483,600)
	★ SUBTOTAL				7,621,815
	SUBTOTAL				41,562,940
	SUBTOTAL DIRECT COSTS				49,184,755

ALTERNATIVE 7-11 & 15 OPTION 1

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2,770	LF	2,250	6,232,500
1.	CONVEYOR	2,030	LF	2,250	4,567,500
★ 2.	CONVEYOR ENCLOSURE (THRU REPUB.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(11,205,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				15,324,240
	SUBTOTAL DIRECT COSTS				22,946,055

ALTERNATIVE 12 & 16 OPTION 1 PAGE 1 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13.90	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	22.04	ACRE	4,000	88,160
2.	EARTHWORK (CUT & COMPACTED FILL)	165,410	CY	5	827,050
					(915,210)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	32.50	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
1.	SURGE BIN/HOPPER	1	EA	475,000	475,000
★ 2.	DOCK HOPPER	1	EA	325,000	325,000
3.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
4.	DOZERS	2	EA	248,000	496,000
5.	50 TON HAULERS (ACTIVE)	16	EA	290,000	4,640,000
6.	50 TON HAULERS (RESERVE)	16	EA	290,000	4,640,000
7.	HAUL ROAD (24' PVMT SECTION)	53,670	SY	25	1,341,750
8.	RETAINING WALL	47,250	SF	20	945,000
9.	TRUCK DUMP	1	EA	30,000	30,000
10.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
					(14,942,750)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				15,984,210 ✓

ALTERNATIVE 12 & 16 OPTION 1 PAGE 2 OF 2

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2,770	LF	2250	6,232,500
1.	CONVEYOR	2,030	LF	2250	4,567,500
★ 2.	CONVEYOR ENCLOSURE (THRU REPUB.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(11,205,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				20,350,460
	SUBTOTAL DIRECT COSTS				27,972,275

ALTERNATIVE 14 OPTION 1

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	$13^{\underline{40}}$	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	17.45	ACRE	4000	69,800
2.	EARTHWORK (CUT & OFFSITE SPOIL)	211,900	CY	7	1,483,300
3.	ACCESS ROAD	4045	SY	12	48,540
4.	RAIL REMOVAL	6500	LF	6	39,000
					(1,690,690)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	$32^{\underline{50}}$	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
★ 1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	248,000	496,000
4.	SHIPLOADER	1	EA	1,850,000	1,850,000
5.	REIN. CONC. BIN WALLS	18,600	SF	15	279,000
6.	SPECIAL PURPOSE VEHICLE	1	EA	25,000,000	25,000,000
7.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
					(30,000,000)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				31,766,890 ✓

ALTERNATIVE 14 OPTION 1

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2770	LF	2250	6,232,500
1.	CONVEYOR	3530	LF	2250	7,942,500
★ 2.	CONVEYOR ENCLOSURE (THRU REPUB.)	1,500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(14,580,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
G.	SPECIAL PURPOSE VESSEL LOADING FACILITY				
1.	WHARF (STEEL SHEET PILING)	77,000	SF	13.50	1,039,500
2.	REIN. CONC. ANCHORS	655	CY	150	98,250
3.	TIE RODS, 2½" ⌀	8250	LF	3	24,750
4.	REIN. CONC. DECK CAP	360	CY	150	54,000
5.	TIMBER FENDER SYSTEM	700	LF	32.50	22,750
6.	MOORING DEVICES	12	EA	850	10,200
7.	ANCHOR PILES	2200	LF	9	19,800
	SPV LOADING FAC. SUBTOTAL				(1,269,250)
	★ SUBTOTAL				7,621,815
	SUBTOTAL				40,777,390
	SUBTOTAL DIRECT COSTS				48,399,205

ALTERNATIVE 5, 6, 7, & 8 OPTION 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUT & DEEPENING				
1.	DREDGING	NONE	—	—	—
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	14	ACRE	4000	56,000
2.	EARTHWORK (CUT & OFFSITE SPOIL)	81,500	CY	7	570,500
3.	ACCESS ROAD	3425	SY	12	41,100
4.					(667,600)
C.	WHARF CONSTRUCTION				
1.	WHARF (STEEL SHEET PILING)	111,300	SF	13.50	1,502,550
2.	REIN. CONC. ANCHORS	945	CY	150	141,750
3.	TIE RODS, 2 1/2" φ	11,925	LF	3	35,775
4.	REIN. CONC. DECK CAP	710	CY	150	106,500
5.	TIMBER FENDER SYSTEM	1200	LF	32.50	39,000
6.	MOORING DEVICES	20	EA	850	17,000
7.	ANCHOR PILES	3200	LF	9	28,800
					(1,871,375)
D.	MATERIAL HANDLING SYSTEM				
1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	248,000	496,000
4.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
5.	BIN WALLS	20,950	SF	15	314,250
6.					(3,185,250)

ALTERNATIVE 5,6,7 & 8 OPTION 2 PAGE 2 OF 2

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
7.					
8.					
9.					
10.					
	TRANSSHIPMENT SUBTOTAL (B+C+D)				5,724,225 ✓
E.	CONVEYOR SYSTEM				
1.	CONVEYOR	4150	LF	2250	9,337,500
2.	CONVEYOR BRIDGE	LUMP	SUM	1,600,000	1,600,000
3.	BRIDGE PILING SUPPORTS	300	LF	9	2,700
4.	SPREAD FOOTING CONVEYOR SUPPORTS THRU SWAMP	75	CY	150	11,250
5.	EARTHWORK	6300	CY	5	31,500
6.	CONVEYOR SYS. SUBTOTAL			--	(10,982,950)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	SUBTOTAL DIRECT COSTS				16,957,175

ALTERNATIVE 9 & 13 OPTION 2 PAGE 1 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUT & DEEPENING				
★ 1.	DREDGING	38,350	CY	13.90	533,065
B.	SITE DEVELOPMENT				
1.	CLEARING AND GRUBBING	9.64	ACRE	4,000	38,560
2.	GRADING	46,700	SY	3	140,100
3.	EARTHWORK	133,000	CY	5	665,000
					(843,660)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDERING SYSTEM	1100	LF	32.50	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
★ 1.	DOCK / HOPPER	1	EA	325,000	325,000
2.	OFFICE BLDG. CONTROL CENTER	1	EA	50,000	50,000
3.	STACKER / RECLAIMER	1	EA	2,000,000	2,000,00
4.	DOZERS	2	EA	248,000	496,00
					(2,871,000
	TRANSSHIPMENT SUBTOTAL (B+C+D)				3,840,910
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2770	LF	2,250	6,232,50
1.	CONVEYOR	8,580	LF	2,250	19,305,00
★ 2	CONVEYOR ENCLOSURE (THRU REPUB.)	1500	LF	250	375,000
★ 3	CONVEYOR TUNNEL	30	LF	1000	30,000

ALTERNATIVE 9 & 13 OPTION 2 PAGE 2 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
4.	BRIDGE (N & W R.R.)	LUMP	SUM	INCLUDED	IN ITEM E-1
5.	BRIDGE (E. 9TH ST.)	LUMP	SUM	INCLUDED	IN ITEM E-1
6.	CONVEYOR HOUSING		LF	INCLUDED	IN ITEM E-1
	CONVEYOR SYS. SUBTOTAL				(25,942,500)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				22,944,660
	SUBTOTAL DIRECT COSTS				30,566,475

ALTERNATIVE 10 OPTION 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13.90	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	17.45	ACRE	4,000	69,800
2.	EARTHWORK (CUT & OFFSET SPOIL)	293,500	CY	7	2,054,500
3.	ACCESS ROAD	4045	SY	12	48,540
4.	RAIL REMOVAL	6500	LF	6	39,000
					(2,211,840)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	32.50	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
4.					(126,250)
D.	MATERIAL HANDLING SYSTEM				
★ 1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	248,000	496,000
4.	SHIPLOADER	1	EA	1,850,000	1,850,000
5.	REIN. CONC. BIN WALLS	18,600	SF	15	279,000
6.	SPECIAL PURPOSE VESSEL	1	EA	25,000,000	25,000,000
7.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
					(30,000,000)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				32,338,090

ALTERNATIVE 10 OPTION 2

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★0.		2770	LF	2250	6,232,500
1.	CONVEYOR	3,830	LF	2250	8,617,500
★2.	CONVEYOR ENCLOSURE (THRU REFUE.)	1500	LF	250	375,000
★3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(15,255,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
G.	SPECIAL PURPOSE VESSEL LOADING FACILITY				
1.	WHARF (SHEET STEEL PILING)	91,000	SF	13.50	1,228,500
2.	REIN. CONC. ANCHORS	770	CY	150	115,500
3.	TIE RODS, 2½" ϕ	9750	LF	3	29,250
4.	REIN. CONC. DECK CAP	360	CY	150	54,000
5.	TIMBER FENDER SYSTEM	700	LF	32.50	22,750
6.	MOORING DEVICES	12	EA	850	10,200
7.	ANCHOR PILES	2600	LF	9	23,400
	SPV LOADING FAC. SUBTOTAL				(1,483,600)

★ SUBTOTAL 7,621,815

SUBTOTAL 42,237,940

SUBTOTAL DIRECT COSTS 49,859,755

ALTERNATIVE 14 OPTION 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13.90	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	17.45	ACRE	4,000	69,800
2.	EARTHWORK (CUT & OFFSITE SPOIL)	233,100	CY	7	1,631,700
3.	ACCESS ROAD	4045	SY	12	48,540
4.	RAIL REMOVAL	6500	LF	6	39,000
					(1,789,040)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	440	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	32.50	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM			--	
★ 1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	248,000	496,000
4.	SHIPLOADER	1	EA	1,850,000	1,850,000
5.	REIN. CONC. BIN WALLS	18,600	SF	15	279,000
6.	SPECIAL PURPOSE VEHICLE	1	EA	25,000,000	25,000,000
7.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
					(30,000,000)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				31,915,290 ✓

ALTERNATIVE 14 OPTION 2 PAGE 2 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2770	LF	2250	6,232,500
1.	CONVEYOR	3830	LF	2250	8,617,500
★ 2.	CONVEYOR ENCLOSURE (THRU REPUB.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(15,255,000)
F.	UTILITIES	LUMP	SUM	250,000	250,000
G.	SPECIAL PURPOSE VESSEL LOADING FACILITY				
1.	WHARF (STEEL SHEET PILING)	77,000	SF	13.50	1,039,500
2.	REIN. CONC. ANCHORS	655	CY	150	98,250
3.	TIE RODS, 2½" ϕ	8250	LF	3	24,750
4.	REIN. CONC. DECK CAP	360	CY	150	54,000
5.	TIMBER FENDER SYSTEM	700	LF	32.50	22,750
6.	MOORING DEVICES	12	EA	850	10,200
7.	ANCHOR PILES	2200	LF	9	19,800
	SPV LOADING FAC. SUBTOTAL				(1,269,250)

★ SUBTOTAL 7,621,815

SUBTOTAL 41,600,790

SUBTOTAL DIRECT COSTS 49,222,605

ALTERNATIVE 12 OPTION 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13^{90}	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	22.04	ACRE	4000	88,160
2.	EARTHWORK (CUT & COMPACTED FILL)	165,410	CY	5	827,050
					(915,210)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	32^{50}	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
1.	SURGE BIN/HOPPER	1	EA	475,000	475,000
★ 2.	DOCK HOPPER	1	EA	325,000	325,000
3.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
4.	DOZERS	2	EA	248,000	496,000
5.	50 TON HAULERS (ACTIVE)	16	EA	290,000	4,640,000
6.	50 TON HAULERS (RESERVE)	16	EA	290,000	4,640,000
7.	HAUL ROAD (24' PVMT. SECTION)	53,650	SY	25	1,341,250
8.	RETAINING WALL	47,250	SF	20	945,000
9.	TRUCK DUMP	1	EA	30,000	30,000
10.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
					(14,942,250)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				15,984,210✓

ALTERNATIVE 12 OPTION 2 PAGE 2 OF 2

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2770	LF	2250	6,232,500
1.	CONVEYOR	2,180	LF	2250	4,905,000
★ 2.	CONVEYOR ENCLOSURE (THIRD REPUB.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(11,542,500)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				20,687,960
	SUBTOTAL DIRECT COSTS				28,309,775

ALTERNATIVE 16 OPTION 2 PAGE 1 OF

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	38,350	CY	13.90	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	22.04	ACRE	4,000	88,160
2.	EARTHWORK (CUT & COMPACTED FILL)	165,410	CY	5	827,050
					(915,210)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDER SYSTEM	1100	LF	32.50	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
1.	SURGE BIN/HOPPER	1	EA	475,000	475,000
★ 2.	DOCK HOPPER	1	EA	325,000	325,000
3.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
4.	DOZERS	2	EA	248,000	496,000
5.	50 TON HAULERS (ACTIVE)	16	EA	290,000	4,640,000
6.	50 TON HAULERS (RESERVE)	16	EA	290,000	4,640,000
7.	HAUL ROAD (24' PVMT SECTION)	53,670	SY	25	1,341,750
8.	RETAINING WALL	47,250	SF	20	945,000
9.	TRUCK DUMP	1	EA	30,000	30,000
10.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
11.	REIN. CONC. BIN WALL	6175	SF	15	92,625
					(15,035,375)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				16,076,835

ALTERNATIVE 16 OPTION 2 PAGE [illegible] OF [illegible]

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT PRICE	EXTENSI[ON]
E.	CONVEYOR SYSTEM				
★ 0.	~~CONVEYOR~~	2770	LF	2250	6,232,500
1.	CONVEYOR	2180	LF	2250	4,905,000
★ 2.	CONVEYOR ENCLOSURE (THEN REVUB.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(11,542,500)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				20,780,585
	SUBTOTAL DIRECT COSTS				28,402,400

ALTERNATIVE 11 & 15 OPTION 2 PAGE 1 OF 2

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
A.	BANK CUTS & DEEPENING				
★ 1.	DREDGING	58,350	CY	13.70	533,065
B.	SITE DEVELOPMENT				
1.	SITE PREPARATION	12	ACRE	4,000	48,000
2.	ACCESS ROAD	4045	SY	12	48,540
3.	TRACKWORK	500	LF	70	35,000
4.	EARTHWORK (CUT & COMPACTED FILL)	133,000	CY	5	665,000
					(796,540)
C.	WHARF CONSTRUCTION				
★ 1.	REIN. CONC. CAP DECK	490	CY	150	73,500
★ 2.	TIMBER FENDERING SYSTEM	1100	LF	32.50	35,750
★ 3.	MOORING DEVICES	20	EA	850	17,000
					(126,250)
D.	MATERIAL HANDLING SYSTEM				
★ 1.	DOCK HOPPER	1	EA	325,000	325,000
2.	STACKER/RECLAIMER (COMPLETE)	1	EA	2,000,000	2,000,000
3.	DOZERS	2	EA	[illegible]48,000	416,000
4.	HOPPER CARS (ACTIVE)	100	EA	38,000	3,800,000
5.	HOPPER CARS (RESERVE)	20	EA	38,000	760,000
6.	LOCOMOTIVES	4	EA	532,300	2,124,200
7.	OFFICE BLDG/CONTROL CENTER	1	EA	50,000	50,000
8.	SURGE BIN & HOPPER	1	EA	475,000	475,000
					(10,035,200)
	TRANSSHIPMENT SUBTOTAL (B+C+D)				10,957,990

ALTERNATIVE 11 & 15 OPTION 2 PAGE 2 OF

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
E.	CONVEYOR SYSTEM				
★ 0.	CONVEYOR	2770	LF	2250	6,232,500
1.	CONVEYOR	2180	LF	2250	4,905,000
★ 2.	CONVEYOR ENCLOSURE (THRU REFUS.)	1500	LF	250	375,000
★ 3.	CONVEYOR TUNNEL	30	LF	1000	30,000
	CONVEYOR SYS. SUBTOTAL				(11,542,500)
F.	UTILITIES	LUMP	SUM	250,000	250,000
	★ SUBTOTAL				7,621,815
	SUBTOTAL				15,661,740
	SUBTOTAL DIRECT COSTS				23,283,555

PHONE CALL REPORT
October 29, 1979

LORAIN HARBOR

1. Mr. Ken Glinwa, American Steamship Company, Buffalo, NY, 716/854-7644.

SPECIAL PURPOSE VESSEL:

Assuming proper maintenance is performed on the vessel annually, the life expectancy of the special purpose vessel should exceed 60 years. Over a 50 year period, the cargo hold will require two (2) complete renovations. At todays prices, renovating the cargo hold of a SPV (630' length x 68' beam) would cost approximately $750,000.

2. Mr. Al Rowan with McDowell Wellman, 216/621-9934.

STACKER/RECLAIMER:

The life of the stacking/reclaiming system is estimated at 25 years. The major components requiring replacement are the main bearings which have a life of only 5 years. The cost of replacing the bearings is estimated at $300,000 to $400,000. The annual O&M costs provided by McDowell Wellman include an allowance for regular replacement of wear items such as buckets, belts, pulleys, idlers, etc.

SHIPLOADER:

McDowell Wellman has shiploaders that have been in continuous operation for over 30 years. Mr. Rowan's opinion is that shiploaders should have a life expectancy of 50 years or more. The annual O&M costs include allowances for regular replacment of wear items such as pulleys, drive boxes, cables, etc.

3. Mr. Norm Skinner with W. W. Williams Co., Warrendale, PA, 412/776-3676.

DOZER (CRAWLER TRACTOR):

Mr. Skinner advised that the useful life of construction equipment is measured in hours of operation. The average life of a dozer is 10,000 hours.

50 TON HAULER:

The average life of a hauler ranges from 15,000 up to 20,000 hours. The O&M estimates for the haulers and dozers include allowances for standard replacement and rebuilding of major items such as tires, under carriages, engine overhauls, etc.

4. Mr. Pete Bugjo with General Electric, Erie, PA, 412/455-5466, Ext. 3475.

LOCOMOTIVE:

The minimum life of a locomotive is 15 years and the average is 20 years. Assuming normal operating conditions and that the locomotives are properly maintained, a major overhaul would be required twice during a 20 year period. Each overhaul would cost approximately $75,000 and would include a complete engine rebuilding, replacing trucks, generators, etc.

5. Mr. William Mensch with Jervis B. Webb Company, Farmington Hills, MI, 313/553-1000.

CONVEYOR SYSTEMS:

Mr. Mensch explained that conveyor systems are designed to a customer's required life expectancy. In the case of Lorain Harbor, the stationary structures would be designed for a 50 year life. The exception would be the conveyor enclosure which has a life expectancy of 25 years. The present cost of the enclosure is $200/LF. The main moving parts will require replacement and their life expectancy varies from component to component. The belting ($70/LF) has a 5 year life, the carrying idlers ($65/LF) and the return idlers ($15/LF) both have a 10 year life and the drives ($110/horsepower) have a 20 year life.

6. Mr. Paul Bailey with Bessemer & Lake Erie RR Co., 600 Grant St., Pittsburgh, PA, 412/566-6420.

Mr. Dick Huhn in Industrial Engineering (528-4136) returned the call and provided the following information:

1. Car life - 50 years.

2. Wheel change - once a year. The cost per pair of wheels (4 pair per car) is estimated at $35.00.

3. Minor rebuild at 15 years and at 40 years - $6,000 per car.

4. Major rebuild at 25 years - $10,00 to $12,000 per car.

This information is based on the assumptions that: the ore jenny's will be solid botton cars, emptied by rotary dumpers; the car bodies will receive increased wear due the frequency of loading and unloading; the cars will be subject to a 'captive move' by one railroad and their operation will fall under the Federal Railroad Administration's

(FRA) regulation. The legal life of a car governed by FRA is 50 years. If the cars were to fall under the jurisdiction of the Association of American Railroads (AAR) their legal life could not exceed 40 years.

William J. Flick, P.E.

WJF/dag

cc: John Zorich, Corps of Engineer
Buffalo District

bcc: DWB/CF, MRJ/AF, GJK, ELW/LWS/WJF
S.O. #13402-00-ARA

PHONE CALL REPORT
August 2, 1979

LORAIN HARBOR

Allen Rowan (Al) with McDowell Wellman

1. Shiploader -

Total labor costs including supervision/finges, etc.		$510,000/yr.
Maintenance		$100,000/yr.
Power (1500 HP)	suggest	$ 60,000/yr.*

2. Stacker/Reclaimer

Total Labor Costs		$510,000/yr.
Maintenance		$175,000/yr.
Power (2700 to 3000 HP)	suggest	$120,000/hr.*

*@4¢/KW-hr -- @ 8 mil. TPY

3. Shiploader - loading rate: 6000 TPH**

**This figure differs from the 2,500 TPH rate given earlier by Bob Wellman.)

PHONE CALL REPORT
October 16, 1979

LORAIN HARBOR

Noel Basset with American Steamship Company, phone 716/854-7644.

SPECIAL PURPOSE VESSEL STATISTICS:

- 630' x 68' beam x 40 ht.
- max. cargo approx. 24,000 long tons with 27.5' draft.
- use 20,000 long tons to reduce draft.

LORAIN HARBOR

PUBLIC WORKSHOP

LORAIN CITY HALL

INTRO - DON LIDDELL/ROLF SIMONSEN
BUFFALO DISTRICT, CORPS OF ENGINEERS

PRESENTATION - MAX R. JANAIRO, JR.
MICHAEL BAKER, JR., INC.

DISCUSSION:

Pat Manley, Republic Steel: Would the Federal portion of the project cost include those items generally identified with dredging and making the bank cuts? Would the remaining capital cost items fall to private sectors?

Max R. Janairo, Jr., Michael Baker, Jr., Inc.: All of the cost for land plus the relocation of utilities and people would be non-Federal costs. The bridges, tunnel, breakwater, channel winding, and erosion protection measures required to go in along the channel would be Federal costs.

John Zorich, Corps of Engineers: The Corps' position is that we have a single user upstream of American Ship Building. Therefore, the cost sharing that exists for the direct transshipment, the breakdown between Federal and non-Federal, is wrong in this tabulation. The costs for general navigation improvements from American Ship Building on up to U.S. Steel would have to be cost shared 50/50 rather than the breakdown as it is now. The reason for this again being that there is only a single user that can be identified for 1000 footers from American Ship Building on up to the head of navigation. If that is true, there will have to be modifications in the cost sharing of the present tabulation. For instance, rather than Alternative 1 being 143 million dollars Federal and 15 million dollars

non-Federal, it would be more like 79 million dollars Federal and 79 million dollars non-Federal for Alternative 1 through 3.

Karl Kummant, U.S. Steel: Alternatives show that transshipment facilities are located just below the 21st Street Bridge. By locating the docks and unloading facilities on the northside of the Black River, the material will have to cross the river to the southside. Why was the northside chosen?

Wm. J. Flick, Michael Baker, Jr., Inc.: The area on the southside is regarded as a wetland. The indications that we received were that construction on that side of the river would receive opposition primarily from the Fish and Wildlife Commission. Therefore, we were encouraged to favor the northside of the river.

Zorich: I believe that was at the Corps' direction. In a meeting with Michael Baker approximately a month and a half ago, that was the direction we gave them.

Manley: Could we set up a chart to see where the wetland area is?

Participant "A": If you implement your Alternative No. 1 and construct a new channel through Riverside Park, where will the access to the water treatment facility be located?

Janairo: We have not identified the access to the Sewage Treatment Facility because one of the things that has not been established yet is what to do with the river that remains after we open up the channel. We have a new route for the river, but what will happen to the old backwater area? If that area is going to be covered, then it will be a normal cross. If it is not going to be covered, then a bridge will have to be built.

Manley: What about the users in the other harbor?

Janairo: We do have to consider those.

Manley: Would you consider having a bridge?

Janairo: We may be closing off the old channel just downstream of the cut through Riverside Park.

Manley: Without eliminating the old channel entirely?

Janairo: Correct, we are not going to completely fill it.

Participant "A": Then would you propose shutting off or closing off the old channel?

Janairo: We would have to close off the old channel to direct the flow of the river into the new channel. We would provide a certain amount of flow through the old channel, but not the same amount of flow as in the past, only enough flow to keep the water moving.

Kummant: Why do you have to keep the water flowing? What is the reason?

Janairo: One of the possibilities is that this will become a collection point for debris, then sedimentation will build up and start to fill in. If it starts to fill in, we have a dredging problem.

Kummant: At the turning basins, where the river has a much bigger cross-section and much slower water flow, this has not been a dredging problem due to the accumulation of sediment.

Janairo: Thank you. Good comment.

Participant "B": I may have missed your explanation just now. What is the reason why access to the sewage treatment plant and Coast Guard Area have not been incorporated in the Alternatives with the cut through Riverside Park?

Janairo: We have not finalized exactly what is the best approach on this Alternative. We have worked on these studies and are approximately 2/3 finished. What we need now are your comments so we can finish. Access to the sewage treatment plant area is one of the items that has not been finalized.

Manley: If you built a land level bridge immediately adjacent to the existing Erie Avenue Bridge, you would not be blocking anything in the old channel or the new channel?

Janairo: That is correct.

Manley: It is not a really complicated or technically difficult solution.

Janairo: A bridge is not going to be that large because a certain amount of the old channel will have to be blocked off. To what degree is not known at this time.

Participant "C": Was there any consideration at all given to the possibility of one replacement bridge constructed mid-way between the Erie Avenue Bridge and the 21st Street Bridge? This bridge could be located in the center of the downtown area. Is there any possibility to improve the road systems in that area to utilize this one bridge instead of the two existing bridges?

Janairo: One bridge to replace the 21st Street and Erie Avenue Bridges. No, that has not been considered.

Participant "C": How about the road system, was that considered?

Janairo: No, that was not considered.

Participant "C": Would it be feasible?

Janairo: It would be, but I could see certain inconveniences.

Participant "C": There are going to be inconveniences due to the channel cut you are proposing through Riverside Park.

Janairo: Let me ask Jim Hamilton to address that if he can.

Jim Hamilton, Michael Baker, Jr., Inc.: I think the primary determinant of that would be the acceptability to the City. Are they willing to take both of the locations and combine them into one. The same problem exists with the structure. If you go over the river with a high

level bridge, you would end up half a mile on either side of the river before you touch down, but those problems exist at any location. Another question is, would it be acceptable to consolidate the traffic at one point to cross the river?

Participant "C": Yes this is true, I see your point.

Hamilton: My initial reaction was that with the existing traffic patterns already established, we would like to stay with this orientation. Therefore, a single replacement bridge would not be an acceptable solution because it would require a completely new orientation of traffic.

Participant "C": My consideration in suggesting one bridge was a cost savings. Building one bridge instead of two would make a significant difference in the cost.

Janairo: The terminal point for the bridge would have to be somewhere close to the main road that goes downtown. It would appear that the replacement bridge would have to be upstream, rather than closer to the city.

Manley: Are you planning to construct a new bridge parallel to the N&W railroad bridge?

Janairo: It would be some place in the vicinity of the 21st Street Bridge. There are definite problems with building a bridge on the downstream side of the Erie Avenue Bridge. There are problems of blocking the view, especially of people in this building. Additionally, we have the problem of completely bypassing the downtown area. One way to get around that problem and still have people routed back to the downtown area would be to build a new bridge upstream and then force the traffic back into the downtown area.

Gavin Sproul, AMSHIP: What beam did you use for a 1200 foot ship?

Janairo: For a 1200 foot vessel, we estimated a 130 foot beam.

Participant "D": Was inflation considered in your cost estimate?

Janairo: No, these cost estimates are 1979 prices.

Participant "E": What are the possibilities of 1200 foot boats?

Janairo: Let me ask the Corps to address that particular question.

Don Liddell, Corps of Engineers: At the rate ships have moved in the last 10 to 15 years and the advantages of having greater bulk for the same crew and the same energy expenditure, the shipping industry is probably going to consider larger vessels. Whether it turns out to be 1100 foot or 1150 foot vessels is not known. In a maximum ship size study that the Division did, approximately within the last year, it appeared as though the 1200 foot length would be about the maximum that the ships would attain. One reason is that all of the docks are built with drafts and sils that fit the dimensions of 1200 foot vessels. We believed the 1200 figure represented a maximum. If an Alternative fits the 1200 foot figure, then it will certainly be sufficient for a 1150 foot vessel if that becomes the maximum figure. There is a limit and it appears as though 1200 will be the maximum.

Participant "F": Do you have a general guideline for the participation breakdown?

Janairo: The general guideline that we have is pretty much as I have previously mentioned. Those capital costs which go into navigation that will take care of all or a majority of commercial interests would be Federally funded. Those investments that have to do with the acquisition of land, the relocation of utilities, the removal of homes, and

the relocating of people would be non-Federal costs. In addition to this, as John Zorich has mentioned, if there is only a single user, then there is a cost sharing to be applied, in this case 50/50.

Participant "F": Would the bridges be 100% Federal funded?

Janairo: I would say that they would be 100% Federally funded.

Liddell: Except again for relocation of utilities and the other previously mentioned investments.

Manley: In the Alternatives that call for access for the vessels all the way to the end of navigation, is there a requirement that all of the property be steel bulk headed or have allowances been made?

Janairo: No, there is no requirement that it all be steel bulk headed. We used a scale model of a 1000 foot vessel and placed it on a plan drawing of the river. By maneuvering it around and looking at the way a bow thruster would be used on this vessel, we could determine which banks needed protection. There is a certain amount of the channel which needs to be bulk headed with steel sheet piling. The total lineal feet of this, Bill did you come up with an estimate?

Flick: I do not have a quantity yet. We have an allowance for it in our cost estimate, but I am not sure of the minimum length required.

Janairo: But we have determined that it will not have to be bulk headed all the way.

Manley: In your maneuvering plot chart, where you showed the vessel position, any time there was a cut, is it a vertical cut to channel depth and would it be retained by steel sheet piling?

Janairo: Pretty much so.

Manley: And would it be bulk headed?

Janairo: It would be.

Manley: A parallel question. Was there any soils data available at those cut sites to get any idea of the existing soil condition?

Janairo: No, we used the existing data that we had. These Alternatives are only preliminary cost estimates. As we focus on which Alternative is going to be used and presented, we will be getting into more detailed studies of the type of material available.

Kummant: Did the proposed cuts have the benefit of a review by ship masters experienced in navigating the Black River channel?

Janairo: Our principal take off on these cuts were from the Masters. In a meeting we had in Cleveland on March 28, they helped us. They showed us where the cuts need to be.

Sproul: Would vessels go up without tugs?

Janairo: Yes. The Masters prefer they go up with no tugs.

Participant "G": Do I understand that they eliminated the 21st Street Bridge? And if you eliminate the 21st Street Bridge, are they going to have another easement up above the river going south or will that be eliminated completely?

Janairo: No, the 21st Street Bridge on the Alternatives we had remains intact or is replaced by a new bridge just up river beside the current 21st Street Bridge.

Participant "G": If you were to rebuild, going up, how are you going to connect Route 611, Brook Road, Route 90, and the new potential road in the study now going to Wellington on Route 58? What would be the cost and would that cost overshadow the cost of the bridge.

Janairo: The new bridge would come back at the existing underpass. We are still tied in at that point here on the right bank and here on the east bank.

Participant "G": Are you going to put pressure on the traffic flow on the 21st Street Bridge and then the Harrison Bridge?

Kummant: The bridge should be substantially in the same location but with a higher clearance.

Janairo: Yes, it is a higher clearance. We go out a little bit further to straighten out the curve that is in the bridge now. And there is a curve that comes in, aligns itself on the bridge, and then curves back out as you get down on the far shore on the east side. All we are doing is straightening it out and eliminating the curve. It pretty much stays within confines of where we are.

Participant "H": Did you mention anything about the N&W Bridge? Can I then presume that is all right?

Janairo: We did not have that as one of our study Alternatives, but it is a question that came up. As yet we have not looked at it. I am not sure if it is at the right height. I do want to look at it before I make the final comment on it. It appears to be the appropriate height.

Participant "I": It appeared to have 120-125 feet of clearance. That sounds like a good clearance.

Janairo: That is correct.

Participant "I": I do not know if it has a 135 foot clearance.

Manley: It's 125 feet.

Janairo: It's 125 foot clearance now? Then it is adequate for a 1000 foot vessel and we would have to address raising the bridge for a 1200 foot vessel. I think there is an adequate horizontal clearance to get through it. I have mentioned earlier these Alternative plan drawings are located along the wall here in this room and we will all be available. I would like to suggest that we do take a break at this time for fifteen minutes.

(BREAK)

Liddell: Before we get started again in the general discussion of the Alternatives, I wonder if John Sulpizio would give us a few words from the Port Authority's standpoint as to the Alternatives, the future of the Port of Lorain, and where he thinks the Port is going.

John Sulpizio, Lorain Port Authority: First of all let me welcome everybody on behalf of the Port Authority. We think that it is essential that everyone participate in the maximum number of steps so that we get the broadest set of opinions on how the study of this program works. Somewhat like you, except that we have had the opportunity to review the Reconnaissance Report, we have not taken any particular position as to which set of recommendations we will support or advocate. The position in the past has been, and will continue to be, that we would like to make upstream modifications for the greater marketability of the Port. We think that upstream modifications, beyond lake front adjustments, will give us a greater opportunity to market and fully utilize to maximum strength lands that are available. Beyond that, we have not combined or withdrawn from the matrix the kind of elements of the project that we like the best. I think after this meeting, with the information in the Reconnaissance Report, and with the presence of a couple of Board members today, we can start taking a closer look at what the Board of Directors and their constituents think is in the best interests of the City of Lorain. We do see, I think that out of this study we are heading towards a specialized kind of Port activity. We have thought a lot of some trade offs to contend with in terms of

sacrifice of land, how to best protect that land, and how to maximumly utilize that land. I can see where it will take a lot of thought and conversation within the City of Lorain before we determine the final recommendation of the Board.

<u>Janairo</u>: Thank you John.

I think we ought to continue now with the question and answer period. One comment that came up during the break was to address ourselves to this intersection of Henderson Drive at Elyria Avenue. It is a crowded intersection as I have discovered by traveling through here. It provides the access into U.S. Steel and access over the bridge on out east. The question was, could the bridge be located so that we can come up with a different intersection at this point (21st Street and Broadway) by either going over the railroad or relocating the railroad some other place. We are going to address that further and see if that can be done. Yes, John.

<u>Sulpizio</u>: I have a question with regard to that wetlands area that was discussed earlier and why the transfer facility was put on the opposite side of the river? I think there is some dispute as to whether it is an environmentally sanct area. As I understand it, Fish and Wildlife is conducting a Four Seasons study, the results of which I have not had the benefit of. I am wondering that as part of this study if we should simply discard that site as an Alternative because we think it is a wetland and because we suspect Fish and Wildlife will protect it. I am wondering if we shouldn't look at Alternatives there or start working with Fish and Wildlife to determine whether or not that is a feasible site. We have a large number of

acres there that could be instrumental in the activities of the Port of Lorain and I think we should start pressing all the people involved so we can get a better understanding as to the exact status of that land.

Janairo: Fish and Wildlife has asked us to divert comments on any of the Alternatives proposed on the Harbor until they complete their Four Season Study. That study is not scheduled for completion until sometime this Fall, so in the meantime we are progressing with this study as far as we can. In the absence of their comments, we now look at what the Corps is charged with as far as protection of the wetlands. First of all, is the area definable as a wetland? I believe the Corps accepts it as being defined as a wetland. And if it is defined as a wetland, their charge, by law, is to perserve as much of the wetland as possible. We looked at the various Alternatives that were available and one of the Alternatives to putting a transfer facility on this site is to put it on the other side (east shore).

Kummant: Just for my terminology, what is the difference between a wetland and a swamp?

Janairo: It is exactly the same.

Manley: Were you referring to an expansion beyond the present navigable limits or were you looking at lands up to the navigable limits?

Janairo: Were you looking down into here? (the wetlands)

Manley: No, I mean when you were making some of your earlier comments.

Janairo: About the wetlands?

Manley: No, about opening up access to other lands.

Sulpizio: Oh, you are talking about my general comments. They still remain general. If you are talking

about if they are cut off at the 21st Street Bridge or if they go to the extent of the navigable limits, I guess I have to repeat and say we would like to see them at the 3 mile limit, but certainly that deserves a lot more analysis. Some of this information presented today is new to us. Thank you.

<u>Manley</u>: I believe up to the U.S. Steel turning basin, the river is navigable. With an option to the 31st Street Bridge, we are not interested in going beyond that point of the 31st Street Bridge. As far as the wetland is concerned, I suggest an Alternative. Because there has been material dumped there for years and years and that has destroyed that entire wetland and the little that is left, I think the Wildlife Service could make an exception and say that it is not a wetland any longer. The cost of restoring the wetland would surpass all the costs it would take to develop it commercially.

<u>Participant "J"</u>:

<u>Janairo</u>: I have seen some of the fill that has gone in here, but I think there still remains some residual wetland and that particular residual wetland is still in question.

<u>Zorich</u>: Do we have any idea of what the difference in cost for the transshipment facility would be if you located it on the left bank versus the right bank? It seems to me that it would not be significant. You still need a storage area there I believe, and I still think there would be a conveyor system required to get it up to the mill. I do not see the cost really being that significantly different.

<u>Janairo</u>: Your biggest cost is going to be on the conveyor bridge. You eliminate that bridge by locating the transshipment facility on the west bank. The cost for the bridge alone is 1.5 million dollars.

Participant: That's with what clearance?

Janairo: 1.5 million dollars for the bridge alone as it goes over the river with 125 foot clearance.

Sulpizio: The Reconnaissance Report which was released in January is this document, and I believe most people have seen it. Are the costs you are showing in your Alternatives consistent with the numbers presented in the Reconnaissance Report, or have they been modified?

Janairo: I think they are different from what is in there.

Liddell: The numbers presented today should represent more detail.

Sulpizio: What is the chance of obtaining a package of this information on an 8-1/2 x 11 form with some of these breakdowns and some of these guidelines for general consumption and digestion, for those of us who are not familiar with the project and would like to have some material to study further.

Janairo: Are we ready to release?

Liddell: I would like for the Corps to review it first. But I don't think there is a problem over some period of time.

Janairo: We still have to give the Corps all of this information. They have not seen it as of yet.

Liddell: Also, the cost breakdown John Zorich was talking about into Federal and non-Federal, the Corps would like to make sure they are all accurately represented.

Janairo: We do have to go back over the cost sharing formulas which John Zorich had talked about, and these would have to be incorporated into the final report.

Participant: I kind of support John Sulpizio's idea. It would give us a chance for a better study, because we would have something with which to work.

Zorich: I think that is desirable and as soon as we get a chance to look at it, either the Corps or the Consultant will see that the principal study participants get copies of appropriate maps and some cost breakdowns. I think that what we are trying to do is get your input and the only way I can see we can get anything valid on your part is if you have the information with which to operate.

Janairo: One of the basic questions that keeps on running through our minds is, have we looked through every Alternative possible to get these large vessels up river. Is there any other way, is there something we have omitted that is within reason?

Participant "K": There is one standout Alternative that is not there. Every case where you made the cut through the park assumes that the Erie Avenue Bridge will remain. My feeling, whether the Erie Avenue Bridge remains or not, is that the Harbor will not work for these big ships if the cut through Riverside Park is not made.

Janairo: As I recall, the Alternatives included some of the replacement bridges for Erie Avenue.

Participant "K": I do not see where the other Alternatives are combined with the cut.

Zorich: The whole reason for the cut in this instance is to try to see that --

Participant "K": I thought the primary reason for the cut was to make the Harbor feasible for 1000 foot ships, not necessarily to save the bridge. I think we have to have that cut whether the Erie Avenue Bridge is replaced or not.

Janairo: Because coming through here being difficult? (i.e., through the existing channel)

Participant "K": I suggest that the cut has to be made for two reasons. One, to make the channel more easily

navigable for 1000 foot ships and two, to develop the outer Harbor.

Janairo: Is there any difficulty in maneuvering in the outer Harbor and trying to get into the existing channel?

Sproul: You cannot get a 170 foot beam ship through that bascule bridge without that cut.

Manley: What about this requirement we are faced with where the Coast Guard is asking for the bridge extension?

Sproul: If the cuts are put in it is okay, but for a 1000 foot ship going through without the cut, we have lost possibly another ten foot clearance at each side because of the Coast Guard rules requiring the pilot house to be all the way out. This means instead of a 20 foot clearance at each side or 19 at one side and 21 at the other side, we have less than 20 feet. Therefore we are looking at ship construction of the superstructure that possibly hinges up.

Manley: This is the flying bridge at the pilot house level?

Sproul: Right.

Manley: The Coast Guard is now saying they want it to go all the way to ship side?

Sproul: Yes.

Manley: Which really creates a problem on the Erie Avenue Bridge.

Sproul: AMSHIP can maneuver newly constructed vessels through it if it is only a one time shot, but if a ship is going in and out all the time, we would have to use six tugs in trying to get through there. There is no way you could try it on your own. (No way a vessel master would try it without tugs.) The use of tugs is expensive and all that does is make it look like the cut is a necessity if you are talking about running big ships up and down the river.

Participant "K": That cut has to be made if the Erie Avenue Bridge remains or not.

Janairo: But even with the cut there, the bridge still poses as an obstruction with the current Coast Guard requirements. Is that what you are also saying?

Sproul: It makes it more difficult.

Manley: I don't know what that height is but you have the bascule bridge open like this and you have that upper limit, you are going through with the pilot house extension or flying bridge extension right to the ships side. So you are like this.

Janairo: You are right, you need that horizontal clearance straight up and down.

Captain Vic Anderson: You need a straight shot through the bridge. You cannot be on an angle or making a turn as you come through it. If you come from the old way, you cannot maneuver.

Janairo: Do I understand that it is not feasible to maneuver the large vessel in through here (pointing to the area around the Erie Avenue Bridge) when you have a different bridge altogether?

Sproul: If the ship has all kinds of tugs on it, you might be all right. If it was a 1200 foot long vessel, you could get snaked around into the corner. You might have to eliminate the treatment plant to straighten out that corner.

Janairo: The widening for the 1200 foot vessel also requires taking some off of here (pointing to the mouth of the Black River) on both sides of the channel.

Participant: Was the new Republic Steel ore dock taken into consideration?

Janairo: Yes it was. That is one of the reasons why in the transshipment facilities on lake front, the stockpiles are located here (upstream of the

Erie Avenue Bridge) because the Republic Steel stockpiles are located below the Erie Avenue Bridge.

Sproul: Also, remember that if you have a Republic Steel ship sitting at their proposed dock, you cannot get another ship through the channel.

Manley: A 1000 footer?

Sproul: Yes.

Manley: If there is a ship at the Republic Steel dock and any size ship is going by and there is any difficulty in navigating, that ship will extend the courtesies that normally prevail on the Great Lakes and will shift back all the way lakeward to allow for maneuvering.

Participant "L": You have the 1000 foot ships going into the coal docks with the unloading and not into the river itself?

Janairo: Yes.

Participant "L": Is that Republic's plan to enter that slip or are they moving down the river?

Janairo: I do not believe that Republic has that as a current plan. I believe their current plan is unloading the ship from riverside.

Manley: We are planning to load on the riverside. However, we have not eliminated options for expansion that could certainly accommodate what is being described here today.

Sproul: How deep is the channel supposed to be?

Janairo: 28 feet all the way to the 3 mile limit.

Manley: At low water depth?

Janairo: Yes.

Sproul: Is it feasible to make it deeper than that?

Janairo: I believe we have some problems if we try to make it deeper. First of all, you do require a new authorization for deepening it.

Liddell: The other harbor might be a little different, but once you get into the river, I think 28 feet is about the limit.

Janairo: We also have some utility tunnels going across the river. We would be getting pretty close to them if we went any deeper.

Sproul: So if we have a 1200 foot ship coming down from the head of the lake, we would have to lighter them? The information that we have is that the 1200 foot vessels would only require 28 foot draft.

Manley: Will that not tie in with the Corps study, Mr. Liddell, where you are looking at the channel deepening?

Liddell: Yes.

Janairo: Any other questions? Don, I'll turn it back over to you.

Liddell: I hope that you will take this opportunity to do some thinking about what you have seen. I think the suggestion and the request was a good one and we had anticipated in making sure that you did get a copy of this as soon as we get a look at it. As I said, the Corps would like to go over it and make sure it does comply with our thinking on cost sharing and costing and some of those things. I do not know how long that will take but it should not take too long. Once we do that and make sure that it conforms with the normal Corps' thinking on navigation, we will get it back out to you. Those of you that are here, of course, we have on our cards and we will assume that you will want a copy and we will get it back to you. Perhaps also some of those who are not here who we know are very interested, we will get it to them too. There is one thing we have not talked about and you

do have to keep in mind. We have not talked about the navigation benefits. In other words, we have the cost on the one side which we can translate into annual costs, but we have not so far translated benefits. As you know, the benefits would probably change depending upon the Alternatives and the load of tonnages and so on that would proceed to a certain point. As we said, these are preliminary and we do want to sort them out and insure that we are carrying on with those that fit the navigational needs and planning and so on as far as the future of the Port of Lorain is concerned. If we had the benefit, or when we get the benefit, there will be some decisions made that may cut out some of the other Alternatives. All of these that we are discussing today are not automatically going to remain eligible.

Manley: In that regard, I wonder if you might consider assessing or determining the benefits that you see that are available in coming to a port like Lorain, which is closer to the western end of Lake Erie, and therefore has a tremendous fuel advantage, as opposed to going to further eastward lake ports as a transshipment facility. And secondly, if you introduce into your thinking, and I do not know how you are going to quantify this but from a safety standpoint, that these kinds of improvements have a tremendous impact not only from the standpoint of ship safety for the crew but for the ship itself. You are concentrating tonnage now into a smaller number of vessels. Therefore, any interruption to service caused by casualty can be quite catastrophic and have a tremendous economic impact

to a particular facility in a region. It is important that the safety factor be considered.

Liddell: The value of the ship itself is a whole lot greater than the other smaller sized vessels.

Manley: Right.

Liddell: I don't know, Mr. Pelone, have you had much of a chance to think about it?

Mike Pelone: Well, I would like to point out that the economic section in Buffalo has initiated the two part survey. The first part is to contact the iron ore docks along the south shore side of Lake Erie and then to identify the inland destinations. On your first point, you are talking about a centralized facility located to the western side of Lake Erie that did not exist before and you might have what I call induced traffic or induced tonnage. At this stage in our iron ore dock and iron ore steel plant survey, nobody has clearly identified the amount of tonnage that might be shifted from Ashtabula and Conneaut out of Cleveland to this facility which will be on line in Lorain in the early 1980's. If you could provide possibly some estimates in your part, we would be very happy to consider them, but at this point surprisingly no one has given us a firm commitment by phone or in writing, that traffic would shift or be induced to Lorain.

Manley: I guess I was not getting at that specifically. I think I was talking about potential in an energy conscience environment that we are starting to live in.

Pelone: Again, our benefit evaluation is constrained by regulations. In this case, the two primary benefits would be the transportation rate savings that would accrue from the use of larger vessels and possibly the delay savings, expressed on a

dollar operating fixed or variable per hour or per day. Possibly multiplied times the number of hours that a vessel would incur delays. So it is transportation rate savings through the use of larger vessels or the delay savings that are the two primary benefits. It is very, very hard to put a value on safety, loss of life, clogging up a major navigation artery say if a 1000 foot vessel was to go down at the lake-front in Lorain. It would be a very major problem but it is very hard to put a dollar value on that. We are aware of the problems from the economics side of it.

Liddell: Your biggest savings, of course, are your rate savings. Changing the mode from a 700 foot or 650 foot vessel to a 1000 foot vessel is the big change. Of course, you (Republic Steel) are already into the mode of bringing the 1000 foot vessels into Lorain.

Manley: Yes, but I am getting into that one step further. I am saying that with the plants our company has located inland or upriver, the impact is not just to the vessel but with maintaining the security of the raw material flow, therefore economic viability is with the plant itself. In a very competitive world cost conscious situation, we all know what has been happening in Mahonning Valley. These kinds of things have to be introduced to these analyses because they have somewhat of an employment protection built into them. I do not know how you quantify that, but it is a real situation.

Liddell: Those are normally considered as secondary benefits and not primary benefits and that makes it difficult. You do not get the same kind of credit for secondary benefits.

Pelone: These secondary benefits could be identified in the report if you can measure them but we cannot credit them toward the actual benefits.

Participant "M": Regarding the Erie Avenue Bridge, does anyone have any projections on how much life is left in it? Is it 25 to 30 years?

Janairo: We have not made an analysis on that.

Participant "N": I sent a copy to the Engineers or some of the Consultants and they should have a copy on it. The basic foundation of the structure should last 50 to 100 years. Performing regular maintenance and replacing parts allocated for refurbishing could conceivably add another 50 years' life to the bridge.

Participant "M": If the Corps was to build a new structure either under or over the river, for instance, to replace the bascule bridge, what would be the anticipated construction date? Approximately 10-12 years away?

Liddell: That is probably not too far off, at least for that type of structure.

Sulpizio: Returning to the benefit analysis question again, in the same vein as Pat suggested, what consideration was given to the potential additional tonnage for cargo made possible for the Port of Lorain by these improvements. In other words, the number of acres under utilized or unutilized and projecting what kind of tonnage could be accommodated on that additional water related land. You are getting increased cargo and commodities beyond just benefit analysis. Based on what is, and of course I think we will all agree that nothing stays as is, we are going to have to look forward to a maximum utilization of our land surrounding the Port.

Liddell: How does that come in, Mike?

Pelone: You have to back up and ask one critical question. John, would these new commodities be moving in 1000 foot vessels and if they would not be, why are they not moving now, and this type of thing. There are probably many reasons why certain commodities are not moving now or why the existing commodities are not moving in larger quantities, hence, larger shipment sizes, i.e., 1000 foot vessels.

It probably has a lot to do with the sourcing of the material, the method of handling and unloading, and the storing of material at the destination, i.e., Lorain.

So a lot of other factors come into play here. I know that there is probably a great deal of potential that exists here in the Lorain Harbor area and it will probably develop over time, but the big question is, "is it necessary to move this material in 1000 foot vessels?" Is there a demand for this size movement? Again, the Corps has contacted the other harbor users, Allied, National Gypsum and Erie Sand, gravel operators, steel companies, etc., and we are always trying to stay as current as we can in our analysis and we will welcome any input for potential new users, especially those that would require output transportation.

But if you could identify such items, they could be credited toward the project, but at this point we do not see anything other than iron ore in the immediate term and possibly some limestone in the very long term and that is it. Quite recently, the coal shipments have been disrupted from Lorain? They may have been a candidate for 1000

foot vessel, but again, the coal has been disrupted so we really do not see anything else other than iron ore primarily.

<u>Sulpizio</u>: How much coal is transported in the Great Lakes based upon sulphur content? What I read and what I hear suggests that the coal shipments are in fact reversed. This possibly will mean coal shipments coming into this area.

<u>Pelone</u>: That is a very easy question to ask, but a difficult thing to respond to, as there are a great deal of factors that come into the transportation of coal. Supply, demand, and emissions criteria change. At the moment, the only coal moving in 1000 foot vessels is low sulphur coming east. There is no backlog going west in terms of high sulfur or high Btu fuel eastern coal.

<u>Manley</u>: I think that is what he is referring to. Would Lorain be a terminus for western coal coming into this area for utility and steam generation?

<u>Pelone</u>: At this point, I do not have a very good handle on that. As far as I know, the only coal burning utility is the one right down there (Ohio Edison) now being served, that is consuming eastern coal.

<u>Participant "O"</u>: In your analysis, have you considered, possibly a a 1000 foot vessel coming in to unload coal not stockpiling but directly loading into railroad cars. There is a potential development. We have an existing railroad system going to Warren, Youngstown, and Cleveland. Now how would you fit that into your analysis cost? There is a potential for development there.

<u>Pelone</u>: My first response to that will be on the cost side. You would have to construct or hypothetically cost out a specialized facility to handle the coal, same as the iron ore.

Participant "O": Get away from hypothetical, just say iron ore.

Pelone: Now I am confused because they have already costed out a hypothetical facility to handle iron ore.

Liddell: But that was local and not for interlake.

Pelone: I see. Well again all possible markets for the iron ore coming into Lorain will be considered. We have Republic transshipping some ore inland and transferring ore to Cleveland. We have U.S. Steel consuming what they bring in locally. If any potential users within the hinterlanding exist, we hope to identify them and hopefully, should a transshipment arrangement be worked out by some lakefront operator, credit them toward the project. At the moment, the analysis has considered that the iron ore upriver to U.S. Steel and the Republic facility would be in operation. Again that will be a specialized shuttle movement to Cleveland and a rail haul inland. To the best of my knowledge, we have not at this time identified any third parties that are now high volume candidates shipping iron ore through the lakefront.

Liddell: Our benefit analyses do not allow us to put in hypothetical benefits. We have to put in benefits that through discussion and correspondence are going to be there. We have to have some sort of commitment on one end or the other that that type of shipping and tonnage is going to occur. Not that exact tonnage is pinpointed, but at least to identify that the need is there and that the supplier and the shipment is identified. We cannot get too hypothetical with benefits.

Manley: At this particular stage in the development of your study, as well as in the development of the

transshipment facility on the lakefront, there are certain proprietary aspects to someone either forecasting or committing to a particular movement. I would assume that in the course of the development of the study, these add something that would become a reality that could be factored in.

<u>Liddell</u>: Right.

<u>Participant "P"</u>: You may call it hypothetical, but I do not. Do you or would you take into consideration the amount of steel or foreign steel that is being dumped in this country and what it might do to the local steel, such as Republic and U.S. Steel and others, because they cannot compete with that. Did you take that into consideration? You might call that hypothetical, but I do not. It is real, because they are dumping it. If they are dumping 25 million tons this year, maybe 5 years from now they will be dumping 30 million tons. Can you take this ability to better compete into consideration?

<u>Liddell</u>: I do not know how we put that in there, Mike?

<u>Pelone</u>: I realize that the amount of foreign made steel entering the Great Lakes hinterland area has risen several times in the last few years, but it is projects like this that lower the transportation cost basis for moving the raw material for the domestic steel industry. Over the long run, that will make the domestic steel industry competitive, stronger, and it will be able to resist the inroads that foreign steel has made in the domestic market. Hopefully, this project will make some positive market. Hopefully, this project will make some positive contribution towards the viability of a good domestic steel industry.

Participant "P": Can you take that into consideration?

Pelone: Again, our benefits are limited by regulation and are primarily transportation costs saving and reduced delays. These contribute to a more efficient transportation system. We are, in effect, directing the problem, a very complex problem, as Mr. Manley and other representatives of the steel industry recognize. You address problems, cost capital, labor productivity, social goals, such as eliminating emissions from domestic steel industries, hence possibly handicapping the competitive position. It is a very complex problem. The problem generally lies outside our Authority for making improvements to Lorain Harbor, but again improvements to Lorain would make some positive contribution to the steel industry.

Manley: But the impact is easily identifiable. I do not know if there is anyone here from the steelworkers, but you could go and draw a direct comparison to foreign steel brought into the United States and the fall off in steel employment.

Pelone: Again, that is a secondary impact.

Manley: How do you evaluate that secondary impact? On the front side of it you divide private costs and government costs in some fairly narrow categories. On the benefit side, it would seem that it would be logical to try to look at employment cost by job protection and what this gentleman is alouding to there out to be some way in quantifying or introducing it into the benefit.

Pelone: Well again, we are still taking one step away from the transportation rate saving.

Manley: But it is an integrated system.

Pelone: I realize that, but again, the Corps of Engineers has been directed to look at the problem and measure the benefits that can be credited toward any project in a very narrow sense. That is just the way this system is. It has evolved in time to that point.

Liddell: It may not be the total economic answer, but it is our Authority answer.

Manley: We will have to change that job description.

Sulpizio: Don, the regulatory constraint on your benefit cost analysis is very businesslike and I want to speak positively to it. This impact concerns me greatly because we do not undertake projects of this magnitude but every other decade. We hope to attack them in 30, 40, and 50 year spans and what we are doing, unfortunately with that regulatory constraint, is addressing what is on line as a demand already and a quantifiable benefit. I have heard it said that if we had to get a 1000 foot vessel to the 3 mile limit, it would be done tomorrow if it was able to be done. That suggests to me that we are going to be into the 1980's, which is too late before that is even going to be possible, with the schedules we are on. This concerns me because from 1980 until the year 2000 or 2010, we may have a growing demand we are not recognizing in our Alternatives. I'm concerned that it is too much responsibility to what is and not giving due thought to what will be overtime, given changing ship technology and industrial means.

Liddell: How do I build that in?

Sulpizio: Well, as said earlier, I ask simple questions.

Liddell: We have those same concerns. It is just not always possible. You can address them, you can talk about them, you can lay it out, but when it comes to the bottom line and counting it up against costs, that is where it stops. You've got a whole bunch of text there, but you cannot pull anything out of it to balance off against costs. Now sometimes, depending on what the project is, the verbage in some of these other secondary considerations swing it, but if you are trying to make a (benefit cost) ratio of 2 to 1 out of one that is likely to be 5 to 1, you just cannot pull those numbers out to put them over there.

Kummant: In your experience, what is the cost benefit ratio, that is, the total cost to annual benefit that has been acceptable in projects like this to Congress?

Liddell: Normally, one to one is okay. The higher they are the higher up on the list they come.

Kummant: One to one is the annual benefit that is supposed to be equal?

Liddell: Equal to the annual cost, interest, and amortization over a 50-year economic life. You then have to include the maintenance costs, but primarily it is annual against annual. And at these interest rates, that turns out to be somewhere around 12 or 15 to 1, somewhere like that. You need annual benefits somewhere around 1/12 or 1/15 of your first cost.

Zorich: If the first cost was 150 million, then you would need 10 million in average annual benefits to support that project in a 1 to 1 benefit cost ratio.

Liddell: The fact that the interest rates go up every year makes that margin smaller all the time.

Menley: You also escalate the appreciation of the facility and its value?

Liddell: No.

Zorich: What I was going to say is, in getting back to the commodity flow through the harbor, I think we look to the Industry to tell us what their projections are for expansion at that particular location. I do not think that we would assume or guess what the future may be based on the capacity that you have to handle the material through a given port, in this case Lorain. We look to the Industry, and I think we have already initiated that with whom we think would be the principal potential users at Lorain. If they indicate to us that there is no chance for future expansion, I just do not see how we would assume there will be future expansion. We are looking to you for that information.

Liddell: If there is a definite possibility with the improvements, we will certainly include it in the analysis. If the improvement is going to lead or could lead to expansion, and there is some way to define and describe what it is, and you know it is more than just an unattainable goal, then there is definite potential. That can be talked about and analyzed.

Kummant: For the benefit of the participants in this session, I would like to recall to memory that U.S. Steel has been asked the question, what is their projection of future requirements. We have responded and the Consultants have the information from us. Our present steel production ranges between 2.8 to 3.5 million tons per year and we are projecting this will increase to 5 million tons per year. Therefore, we are talking about almost doubling the raw material movement through this harbor to the U.S. Steel dock. Of course, this projection

is based on our economic forecast and it depends on how the County's ec nomy goes.

Liddell: Those are the kind of numbers we need to put into rate and time savings.

Kummant: If we did not have some fundamental faith looking at our present situation, the picture would be very bleak, but we do have faith in the future and we have these projections.

Liddell: Right. We do need projections from all the potential users. I am not sure if we have them all or not, but I know we have asked. As far as I know we have asked every existing user for expansion projections. If we have not received something, maybe we can let John Sulpizio know so he can gently remind them or tell them it is important, not just for the study but for the Port of Lorain.

Manley: I would like to go back to what John had mentioned and ask if there has been a change in the Corps' prospective from what was outlined a few years back by General Moore to a group of us in Cleveland. He stated that the Corps is no longer going to take a viewpoint that every harbor is going to have a duplication of facilities, systems that may have existed in the thinking back in 1959 when the seaway opened. He said we are moving towards a regionalized port system. Is that still in part of your consideration?

Zorich: We are not considering it in this particular study.

Liddell: I know that in some of the other studies that are going on, he was talking about some of the other types of ports. I think there is probably potential for that in some localities. I do not know whether we have seen that sort of indication here in Lorain or not. At least, nothing that I have seen would indicate that.

Manley: In U.S. Steel's analysis in looking at transfer site, we looked all the way from the west to all the way down to Erie, Pennsylvania. We made some initial cuts and got it down to five different ports. Ultimately we got to Cleveland and ran into some problems in that area. Had we stayed in Cleveland, triggering off the volumes of tonnage our Ohio plants require, then in all probability there would not be a lakefront facility here, unless some other steel company would have come in. I guess what I am saying is, every port along the lakes going to get a Lorain study?

Liddell: In Lorain, we looked at the origin of destination and so on as far as Lorain goes. I guess what you have to assume, and I do not know what else to do, is if Lorain picks up tonnage from somebody else's port, then we must study that port and subtract the tonnage going to Lorain. There is only so much in the Lake Erie System and except for growth as years go by, there is only so much you have with which to work. We cannot put more tons through all the ports than there are tons.

Zorich: I would say, in general, that each individual harbor is asking for the same thing of Congress, the authorization to study their harbors for modifications.

Liddell: If they have not done it yet, they will as time goes on.

Manley: That is what I am addressing.

Zorich: We just got one for Buffalo here now. Authorization to do a same kind of study except for coal. I think their port is looking into the same thing. Ashtabula wants the same thing Cleveland and Lorain have started.

Liddell: They have not got that far yet. but it will come. I think Conneaut, if the steel plant ever does go there, will come up too for a look and approval. If these folks have something in particular that they want to say concerning an Alternative or a general comment, should they address it to us or do you want it to come straight to you?

Janairo: I think I would rather have it sent straight to Michael Baker, Jr., Inc. We prefer to get it because we are in the process of consolidating all of this material into a report to submit to the Corps. Our address is Box 280, Beaver, Pennsylvania 15009. The Corps will get a copy of your comments as soon as we receive them.

Liddell: That way if you have some particular thoughts or concerns or suggestions that have come out of this or may come out of your further thinking, let them know so it can get built in. Hopefully, the Consultants have been taking some good notes so at least we will be aware of what was said here.

Participant: When will a Public Workshop be held to review the final report?

Liddell: It will be a while from now, at the conclusion of the Preliminary Feasibility Report. Sometime at the end of the summer when the preliminary work actually comes out and is published.

Sulpizio: How soon can we expect the 8-1/2 x 11 copies of the maps and other information?

Liddell: Two or three weeks.

Zorich: Max, are there any revisions you feel that you should be making to the exhibits?

Janairo: There are going to be some revisions we are going to make. The comment that came up

concerning the necessity for replacing the Erie Avenue Bridge despite the Riverside Park cut because of the Coast Guard requirements of having the size of the vessels much larger now than what we had anticipated. That kind of correction has to be addressed. At the same time, we have to address the terminus of the 21st Street Bridge or Henderson Street Bridge to find out if we can alleviate the crowded condition of that particular intersection on the west bank.

__Liddell__: What would be your estimate when you might get a package to the Corps?

__Janairo__: In about three to four weeks.

__Liddell__: Then I would estimate it would take the Corps a couple of weeks to review it. In a month or so from now, we can get this back to you.

__Sulpizio__: Don, when do you start evaluating the Alternatives and start eliminating the unfeasible Alternatives? Does that process begin immediately?

__Liddell__: Yes. I would hope that based on the comments and knowing what we do about the benefits, that we start evaluating them right away.

__Sulpizio__: Would it be possible to have a similar workshop of a small nature like this when we evaluate the Alternatives and look at the benefits?

__Liddell__: I think that we are of the opinion that any time there is a need for that sort of meeting, we are willing to have it. We cannot make those kinds of decisions without your input. I would say yes. I am not saying when, but, yes we will.

__Participant__: When you determine what type of river crossing we are going to have for Erie Avenue in Lorain, will you consider economic impacts to the City itself or will you just consider economic impacts to transportation of ore?

Liddell: Hopefully, we would get those comments from the City.

Participant: The type of overpass would seriously affect our entire city.

Liddell: Right. In our various contacts with the Mayor, the City, and the Port Authority, we know that. Therefore, that would go into our considerations. I would hope that if we proposed an unacceptable Alternative, that the City of Lorain would state that they do not want it and state reasons. This is going to occur on all alternatives, therefore, what we ultimately have to do is take what is best for the most people. Those are the kinds of things we do want to take into consideration.

Participant: Another thing is the tunnel. It may affect us too.

Liddell: Whether you are directing traffic underneath or over top of the river, it is all the same type of consideration.

Participant: You will need to address how the access to the other areas originate from these particular arteries you are choosing.

Liddell: Correct.

Sulpizio: Maybe the Port Authority can help out with the other city departments and other interested persons who have comments. Perhaps we can hold internal sessions, once we have a set of these maps and text and present it internally to get some written and verbal feedback.

Liddell: Very good, that is a good offer.
Okay, thank-you for coming.

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PHONE CALL REPORT
June 6, 1979

LORAIN HARBOR

Received the following information:

For a vessel 630 feet in length and a beam of 68 feet, the estimated operating and maintenance costs in 1978 dollars are as follows:

- Direct operating costs - $6,800 per day. This is the total cost for crew, fuel, stores, fringe benefits, vacation pay and daily operating costs. Fuel and lubricating oil is approximately $1,600. Wages complete, including vacation, fringe benefits, etc. is $4,200 per day. The remaining $1,000 per day goes for stores, supplies, painting, tug rental, etc. The crew's wages of $4,200 are based on a crew size of 29 men. The direct operating costs would be incurred on a daily basis throughout the normal shipping season, say 240 to 250 days a year.

- Winter storage - $100,000 per year (fairly new vessel) ranging up to $300,000 per year (for a 30 year old vessel).

  During the winter months indepth maintenance includes changing liners, pistons, rings, generators, pumps, etc.

  The $100,000 cost might consist of a $20,000 to $25,000 contract to General Electric to go over the entire electrical system, a $20,000 to $25,000 cost to overhaul the main engines, a $10,000 to $15,000 charge to go over and reburbish the conveyor system, tec. These charges are over and above the work that would be performed by the crew itself.

- Crew maintenance during winter storage - For approximately the last two (2) weeks at the end of the shipping season and two (2) weeks prior to the start of the shipping season, the full crew would remain on board. Their costs would be as stated in Item 1 above, times (x) 14 days.

- Lay-up and fitting out - A charge of approximately $200,000 is incurred for laying-up and fitting out during the winter months. This is in addition to the $100,000 identified earlier.

- Insurance - Protection Idemnity Insurance and Hull and Machine Insurance runs approximately $225,000 per year.

o <u>Administrative expenses</u> - Costs for managing fleet operations, maintaining communication network and general overhead runs approximately $100,000 per year.

In general, the total semi-fixed expenses discussed above add up to $600,000 per year.

o <u>Annual cost of capital</u> - To all of the above charges must then be added the cost of financing the vessel. This can be done with ~~the~~ A multitude of different financial arrangements such as mortgate, etc. This capital cost to be paid back on an annual basis would include taxes and also would have to be financed such that the investor would be guaranteed at least 10% percent return on his investment.

In 1978 dollars, this 630 foot special purpose vessel would be in the price range of approximately $22 million.

William J. Flick, P.E.

WJF/dag

cc: DWB/CF, MRJ, GJK, ~~BLW~~/TWS/WJF
S.O. #13402-00-ARA

PHONE CALL REPORT

June 20, 1979

JERVIS B. WEBB COMPANY - CONVEYOR COST ESTIMATE

Mr. William Mensch
Chief Engineer, Bulk Systems
Jervis B. Webb Company
Webb Drive
Farmington Hills, MI 48018
Phone: 313/553-1000

Mr. Mensch responded to our inquiry regarding estimating prices for the lake front transshipment facility and upriver conveyor system. The following estimate is based on our April 1979 conveyor routing scheme. Although the conveyor routing layout has since been modified, the average cost per foot estimating price is still considered to be valid.

- Total lump sum cost: $24,347,481.00
- This cost includes:
  - transfer buildings, sided and roofed
  - heavy conveyor frame
  - 42" wide belt (650 fpm)
  - belt idlers
  - bridge over N&N RR
  - terminal frames, head and tail end
  - skirts and shoots plus 1" liner plates for shoots
  - engineering
  - erection
  - enclosure and walkway over entire length (i.e. Wonder Building)
  - 15 separate conveyor systems
  - transfer buildings, 20' square x 30' height
  - dust collection system in 12 transfer buildings (the erected in place cost for all 12 is $507,800.00)

CONVEYOR $\boxed{\text{5,200 HP}}$ + DUST COLLECTION AND VENTS

~~12,400 HP~~

MOTORS

- average belt tension 600#/in.
- approx. ~~62,000~~ HP required to drive the totally connected system

6,200HP

o The lum sum cost does not include:

- ground level supports for the conveyor frame. (The standard installation would be effected with prestressed conc. ties at 15' o/c. These ties would be equivalent to RR ties 8" square x 8'-6" wide)
- electrical controls (but the motors have been included). The controls would have to be a sophisticated programmable system.
- switches
- concrete foundation (footers) for the (Wonder Building) enclosure. (the footers would be 4' deep x 6" wide rein. conc. or 4' deep x 8" block.)
- grading and site preparation
- gravel walkway (inside of Wonder Building enclosure)

Mr. Mensch indicated that because the belt width was held to 42", this conveyor scheme is not excessively costly because it is somewhat of a conventional design. (He also stated that U.S. Steel had contacted his firm for an estimate to extend the conveyor system into U.S. Steel's Lorain - Cuyahoga works.)

The writer expressed his appreciation on behalf of Michael Baker, Jr., Inc. for the time and effort expended in preparing the quote. Mr. Mensch will confirm the quotes by letter.

WJF/dag

cc: Rolf Simonsen, Project Manager

bcc: DWB/CF, MRJ, ELW/WJF
S.O. #13402-00-ARA

INTER-OFFICE MEMORANDUM MICHAEL BAKER, JR., INC.

TO File DATE May 14, 1979

FROM W. J. Flick SUBJECT Lorain Harbor

Contacted a Mr. Smith, with the Chessie System in Akron, Ohio, phone (216) 253-2215, and requested valuation maps of the Chessie System property within the project study area. Mr. Smith will forward our request to their main engineering office in Huntington and they will advise this office if there will be any charge for the maps. Mr. Smith stated that the maps have not been revised to reflect the recent property acquisition by Republic Steel. In general, the east bound running track (western most track) has been retained to serve Ohio Edison.

WJF/dag

cc: DWB/C-File, MRJ/A-File, GK,Jr., WRK/JMH, ~~EJW~~/TWS/WJF
S.O. #13402-ARA

MEETING REPORT

May 9, 1979

TRANSSHIPMENT FACILITY REVIEW

THOSE PRESENT:

Chuck Gilbert	Corps of Engineers, Buffalo District
John Zorich	Corps of Engineers, Buffalo District
Rolf Simonsen	Corps of Engineers, Buffalo District
Mike Pelone	Corps of Engineers, Buffalo District
John Sulpizio	Director, Lorain Port Authority
Howard Cleveland	U.S. Steel, Lorain Works
Pat Manley	Republic Steel, Cleveland
Max Janairo	Michael Baker, Jr., Inc.
Bill Flick	Michael Baker, Jr., Inc.

DISCUSSION:

Representatives from the Corps and Michael Baker, Jr., Inc. met with the Port Authority at 1:00 P.M. to discuss the Lorain Port Authority's possible involvement in the proposed transshipment facility alternative. The Authority is enthusiastic about the growth of the Harbor as a transshipment facility for handling bulk materials and also for handling general cargo. However, the Authority does not have any definite plans for achieving this objective, but they are willing to support any proposals for development of transshipment facilities.

At 2:00 P.M., representatives from the steel companies joined the meeting.

- The Chessie System property purchased by Republic Steel is bordered by the Black River on the east and the business establishments fronting on Broadway to the west and extends from the lake front to approximately 16th Street. This area encompasses 91.8 acres. Chessie System has retained a right-of-way through this parcel for access to Ohio Edison which is located on the lake front for the purpose of supply coal.

- Republic Steel purchased the Chessie System property pending approval of the Port Authority's bond issue. The ownership of the land will then be transferred to the Port Authority who in turn will lease it back to Republic Steel.

- o Republic Steel is in the process of constructing their transshipment facility on this Chessie System property that they recently purchased. The initial area to be developed will extend from the coal slip upstream to the Erie Avenue Bridge. At this time, nothing will be developed along the east or west piers.

- o Republic Steel is planning on making iron ore pellet deliveries with 1,000-foot vessels. They project 100 vessels per shipping season each carrying a cargo of 60,000 (long) tons. The total volume of pellets to be temporarily stockpiled at Lorain could approach 500,000 tons. Based on a shipping season from April until November, one 1,000-foot vessel will arrive at the Port every 2 days.

- o Republic Steel projects that their transshipment facility in Lorain will be fully operational in the Spring of 1980.

- o U. S. Steel's Lorain Works manufactures tube as their primary product and bar as their secondary product. The bar product is distributed locally in the midwest, but the tubular products are distributed all over the world.

- o U. S. Steel owns approximately 800 acres on the east side of the Black River opposite their present plant facility that could be used for future plant expansion.

- o All limestone delivered to U. S. Steel in Lorain is shipped by self-unloading vessels.

- o Prior to the close of the shipping season, U. S. Steel tries amass a stockpile of 2 million tons of iron ore in the Fall to last them through the Winter.

- o The possibility of constructing a transshipment facility at the lake front and then conveying the iron ore pellets by rail to U. S. Steel's plant was posed. Mr. Cleveland's reaction was:

  1. It might be impossible due to physical limitations inherent in the existing track layout.

  2. His initial estimate is that the cost of rail transfer would be far greater than say a belt-conveyor system.

- o Republic Steel's preliminary proposal for developing Lorain as a transshipment facility was to connect the tips of the east and west pier with steel sheetpiling cells. The

coal slip between the two piers would then be dewatered and possibly sealed with a material such as bentonite to keep the slip water tight and then the iron ore pellets would be stored in this depressed area. Republic Steel did not pursue this idea because they felt that the permitting requirements would pose too many time delays. Possibly this scheme might be incorporated within a future expansion program.

- o Iron ore pellets (taconite) vary in quality. There are probably ten different domestic grades of taconite. Therefore, at a transshipment facility, loads from different mines must be kept separate.

- o At Republic's proposed transshipment facility in Lorain, only one 1,000-foot vessel can be serviced at a time.

- o Republic's proposed facility will only handle pellets. No other forms of iron ore will be delivered to Lorain.

- o Republic Steel emphasized that the government pier, constructed of piling with a concrete cap, that parallels the east pier is badly deteriorated and needs to be removed. Republic fears that the government pier could collapse and would then obstruct navigation in the Black River. The east pier itself is structurally sound and can remain.

- o Republic stated that they are willing to accomodate third parties at their transshipment facility in Lorain. At this time no agreements with third parties have been drafted.

Mr. Cleveland excused himself from the meeting shortly after 4:00 P.M. and the general meeting adjourned at approximately 4:45 P.M.

The Corps advised the Consultants that they would return to their office and confer in-house about the transshipment facility. Within a few days they will contact the Consultants and advise how they want the transshipment alternatives to be handled in the appendix.

MICHAEL BAKER, JR., INC.

William J. Flick

William J. Flick

WJF/dah

cc: Mr. Rolf Simonsen

bcc: DWB/CF, MRJ, JMH/WRK, GJK, EZW/TWS/WJF
S.O.#13402-ARA

MEETING REPORT

May 1, 1979

Meeting on Lorain Harbor with Buffalo District, Corps of Engineers Representatives.

THOSE PRESENT:

Buffalo District, Corps of Engineers

John Zorich	Chief of Planning, Western Section
Ambrose Andre	Chief of Design Section
Rolf Simonsen	Project Manager, Lorain Harbor Study

Michael Baker, Jr., Inc.

Max Janairo
Ed Wiley
John Kurgan
Bill Flick
Bill Kozy
Jim Hamilton
Tom Smith

DISCUSSION:

The meeting was used as a working session to review with Corps of Engineers the progress on the study and to discuss questions concerning the alternates involved. The following is a summary of discussions and questions concerning each of the improvements considered.

1. Outer Harbor

It was stated that the 400 slip marina would require about 16 acres of harbor area. Cellular steel sheet pile breakwater, or similar, would be most desirable to protect the small boat harbor within the inner harbor due to limited space with the cut-through riverside park. However, the Corps of Engineers indicated that a rubblemound breakwater should be considered, due to adverse environmental effects of the vertical steel walls. Reflection of waves is more intense with steel walls. Michael Baker, Jr., Inc. must investigate if the rubblemound breakwater will still permit a 400 slip marina within the inner harbor.

The Corps of Engineers stated that dredging quantities for the proposed project depths could be computed by the difference in elevation from existing project depth multiplied by the area. Since overdredging is often provided, this will allow for overdredging to remain relative to the proposed project depths. This will apply for both the outer harbor and the Black River.

2. Bridges and Structures

ERIE AVENUE TUNNEL: Proposed location of the tunnel is upstream of the present Erie Avenue Bridge. The tunnel will consist of cut and cover type with a section of sunken tube. The location and alignment of the proposed tunnel was considered most adequate.

The Corps of Engineers indicated that due to large amount of pedestrian traffic, some means to accommodate pedestrians should be included in costs.

The type and level of information presented was generally acceptable. The sample text drawing format for the tunnel was acceptable and similar format will be used for the bridges. The comparatively slight differences in the tunnel for 1000' and 1200' vessels may be covered by double dimensioning and/or text description. Essentially, duplicate drawings are not required.

ERIE AVENUE HIGH LEVEL BRIDGE: Location and alignment of the proposed high level bridge was a considerable point of discussion due to its effects on the Lorain business district and the downtown Skyline. It was finally concluded that the proposed alignment, although not entirely desirable, would best represent this alternative.

A walk for pedestrians should also be included in this alternative.

Text discussion of the alignment chosen will include description and comparative evaluation of the other major alternates considered. Double dimensioning is acceptable in place of substantially duplicate drawings for the 1000' and 1200' vessel alternates.

21ST STREET HIGH LEVEL BRIDGE: It was shown that all feasible alignments would traverse the property of Allied Oil and be restricted by the tanks. A pedistrian walk on one side of the bridge would also be necessary. A suggested alternative to a new bridge would be to investigate jacking the existing bridge to the required vertical height for clearance. This cannot be investigated until structural drawings of the existing bridge can be obtained.

Text discussion of the alignment chosen will include description and comparative evaluation of the other major alternates considered. Double dimensioning is acceptable in place of substantially duplicate drawings for the 1000' and 1200' vessel alternates.

3. Channel Improvements

The proposed cut areas were reviewed and the Corps of Engineers indicated agreement on the following points:

1. That additional cuts proposed would be necessary to permit 1000' vessels to navigate the river.

2. For the cut through Riverside Park access to the treatment plant could be provided by filling the old channel.

3. That for Alternate Nos. 1, 2 and 3 the lower turning basin would require enlarging for navigation only (not for turning vessels).

Cost for dredging and bankcuts are highly dependent on disposal of material. Cost for excavation and diked disposal could run \$8/C.Y., while excavation and open lake dumping would cost between \$1 and \$2 per cubic yard. Costs for sheet pile protection of dock areas and rip-rap protection for others should be included. Excavation unit costs should be verified with the Corps of Engineers estimators.

4. Transfer and Transshipment

Alternates 7 and 9 should be developed to include:

1. Special purpose vessels.

2. Rail transport direct to U.S. Steel

3. Truck transport by ~~rail~~ haul road direct to U.S. Steel.

Cost estimates and drawings should be prepared for above alternates.

Alternates 4, 5 and 6 should include the transfer facility on the east side of the river immediately below the 21st bridge. No development should be considered in the wetland area below the 21st bridge on the west bank.

Lakefront transshipment should consider these additional points:

1. Give primary consideration to Republic Steel's "Scheme J".

2. Contact Republic Steel and ask for estimated cost of their proposed facility at Lorain.

3. Corps will advise Michael Baker, Jr., Inc. on what storage capacity should be allowed at Lorain.

4. Hold a conference call in one week ± to discuss with the Corps the involvement of U.S. Steel and Republic Steel, especially cost distribution of the transshipment alternatives.

5. Republic Steel wants 500,000 ton storage capacity. U.S. Steel (?) assumes 120,000, i.e. based on two vessels with max. load of 70,000 long tons.

<u>SUMMARY</u>:

The Corps of Engineers indicated that they would check further upon return to their office on the following points and inform Michael Baker, Jr., Inc. on findings through Rolf Simenson.

1. Status on the possibility of Lorain Harbor as a Harbor of Refuge and its effect on the outer harbor depths.

2. Location and design of additional outer harbor breakwaters.

3. The possibility of disposal of dredge and bank cut material by open lake dumping.

4. Check on quantity and cost data for previous Lorain channel work (i.e. Corps of Engineers Cut No. 1).

5. Advise Michael Baker, Jr., Inc. on storage capacity use for the lakefront facility.

6. Republic and U.S. Steel interaction and requirements at the lakefront facility, with a possible meeting with the Lorain Port Authority, if necessary.

TWS

Thomas W. Smith

TWS/dag

cc: Rolf Simonson

bcc: DWB/C-File, MRJ/A-File, WRK/JMH, ~~WJF~~, ELW/TWS
S.O. #13402-00-ARA

REPUBLIC STEEL NOTES:

From Pat Manley via G. John Kurgan:

- Total storage required by Republic Steel at Lorain is 500,000 tons.
- The average property value of land purchased by Republic Steel was $75,000 to $90,000 an acre.

PHONE CALL REPORT
April 23, 1979

LORAIN HARBOR

Bob Wellman with McDowell Wellman (no longer with company)
phone 216/621-9934.

REFERENCE McDOWELL WELLMAN BROCHURE "SYSTEMS FOR HANDLING BULK MATERIALS"

I. SHIPLOADER: TRAVELING LOADING TOWER

Bob priced one of these in the Fall of 1978 use:

$1,350,000 F.O.B.

Length of travel: 500' (but if required to travel $>$ 500' no Δ in cost.)

8/2
Al Rowan

Capacity: 6,000 TPH

II. STACKING/RECLAIMING SYSTEM:

RAIL MOUNTED TRAVELING - LUFFING BOOM BUCKET WHEEL STACKER - RECLAIMER
(Also called a trencher wheel.

$1,500,000 F.O.B.

Normal boom reach 60' - 75'. Beyond those limits encounter structural difficulties.

To have center of pile 95' from edge, employ two - dozers to move pile to stacker/reclaimer.

* This machine is very versatile. Can direct material to it at say 6,000 TPH and stack 1/2 and send the other 1/2 on through.

* 1000' vessel unloading rate is approx. 7,500 TPH to 10,000 TPH.

* Iron ore pile of refuse: 30°.

III. SURGE BIN: with say 1000 ton hopper use:
$100,000 F.O.B.

will → about 1/2 hr. material storage

IV. DOCK HOPPER: 10,000 TPH
use
$250,000 F.O.B.

V. CONVEYOR BELT SYSTEM

Say: similar to coal

cost? varies $100 to $1000/LF
use: VEPCO conveyor prices + a factor to compensate for the extra weight associated with ore.

* in direction: use metal shutes - cost is negligible compared with $/LF

VI. Coal & rail loading: Just a variation of the surge bin/dock hopper concept.

PHONE CALL REPORT
April 20, 1979

LORAIN HARBOR

1. Called AMSHIP - talked with Gavin Sproul (R. Mayr was on vacation)

2. o Special purpose vessel cost: Referred to Dick Suehrstedt (sewer stead) with Marine Consultants in Cleveland (216) 781-9070.

   o Marine Consultants designed & priced a special purpose vessel for Republic Steel not too long ago.

   Specs. 600' ±
   Cargo capacity 20,000 (long) tons
   Highly maneuverable in rivers
   Capable of navigating the Great Lakes

   o Price range \$25,000,000 to \$30,000,000 at today's prices.

   o O & M?---Marine did not estiamte, but would be similar to any other 600' ± vessel.

   o Continuing with AMSHIP:

   o Republic never went to bid with Marines design, that is - dropped Cleveland Harbor and began developing Lorain.

   o Marine Consultants---Naval Architects

   o Gavin Sprouls est. for a special purpose vessel?---\$30,000,000.

   o Boom length of self unloaders? 250'.
   Reach = 105' - 2 = 52'-6"; 250'-52'-6"
   = 197.5'

   o Can unload @ rt. 's to vessel; compensate by ballasting on side opp. boom.

   o Vessel to vessel transfer? Yes, but one vessel must move if the other remains stationary.

      o 1,000 footer capacity? 60,000 long tons with current draft on Lake.

      Could be 70,000 long tons ideally if 1000 ftrs. could be loaded to max. capacity ignoring draft.

MEETING REPORT

March 30, 1979

ERIE SAND AND GRAVEL CO. - BELOW N&W RR BRIDGE, WEST BANK

Harry Goodman (Vice President?)
Erie Sand and Gravel Company
Foot of Sassafras Street
Erie, PA
Phone: (814) 453-6721

Representing Michael Baker, Jr., Inc.:

Thomas W. Smith
William J. Flick

DISCUSSION:

- Vessel operations conducted by Erie Sand and Gravel in Lorain Harbor experience no difficulties maneuvering because all of their ships are small. Their largest vessel is the S/S J.F. Schoellkopf, Jr.

- Erie Sand and Gravel has no plans at this time to incorporate large vessels into their fleet because:

  1. The sand and gravel business is stable and no major growth projections have been forecast.

  2. Erie Sand and Gravel is small in relation to the competition and their smaller vessels effectively serve the low volume market they transact business with.

  3. The ports Erie Sand and Gravel ships to are mostly small harbors which can't accomodate the larger vessels.

- The attached sheet, provided by Mr. Goodman, summarizes Erie Sand and Gravel's delivery's to Lorain over the last three years. The only cargo that Erie ships to their dock in Lorain is sand, but they will occasionally deliver gypsum rock to the National Gypsum Company's dock.

- The 552' Schoellkopf is the only self unloader in Erie Sand and Gravel's fleet. On the average, it takes this vessel 8 hours to unload.

- As to the routing of a conveyor across Erie Sand and Gravel property, Mr. Goodman strongly recommended that the conveyor be kept as close to RR property as possible.

- Regarding the approximate cost of realestate, Mr. Goodman advised that in 1978 a land purchase with harbor frontage in Sandusky sold for approximately $4,000/acre. (i.e. 634' x 132' parcel sold for $7,600)

WJF/TWS/dlj

WJF

Attachment

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O.# 13402-00-ARA

ERIE SAND STEAMSHIP CO.
A Subsidiary of Koppers Co., Inc.
LAKE TRANSPORTATION
PRODUCERS OF LAKE SAND AND GRAVEL
FOOT OF SASSAFRAS STREET
ERIE, PENNA.

LORAIN CARGOES

1978	M/V John R. Emery	138 loads		
	M/V Lakewood	62 loads		
	M/V Niagara	3 loads		
	M/V J.S. St.John	5 loads		
		208 loads	=	270,310 C.Y.
	S/S J.F. Schoellkopf Jr.	1 load	=	9,910 tons
1977	M/V John R. Emery	84 loads		
	M/V Lakewood	79 loads		
	M/V J.S.St.John	21 loads		
		184 loads	=	314,685 C.Y.
	S/S J.F.Schoellkopf Jr.	2 loads	=	21,414 tons
1976	M/V John R. Emery	106 loads		
	M/V Lakewood	34 loads		
	M/V Niagara	2 loads		
		142 loads	=	158,260 C.Y.
	S/S J.F.Schoellkopf Jr.	2 loads	=	19,920 tons

* M/V - MOTOR VESSEL
S/S - STEAMSHIP

ALL CONTRACTS CONTINGENT UPON WEATHER CONDITIONS, STRIKES, ACCIDENTS AND OTHER CAUSES OF DELAY BEYOND OUR CONTROL.

MEETING REPORT

March 30, 1979

CITY OF LORAIN

Lowell Kneisel, Designer
Engineering Department
City Hall
Lorain, Ohio
Phone: 216/244-1300

Representing Michael Baker, Jr., Inc.:

Thomas W. Smith
William J. Flick

DISCUSSION:

- o Contacted the City's Engineering Department to obtain maps of the City's utilities located within the study area. Mr. Kneisel provided the Engineers with the necessary drawings. The following drawing sheets were obtained: Sheet No's. 1, 2, 10, 11, 12, 26, 27, 28, 29, and 30.

- o Should it become necessary to secure property maps, these would have to be obtained from the County. Mr. Kneisel suggested we contact Mr. Frank Colberg in the Map Department, phone (216)244-6261, in Elyria.

- o The Engineering Department provided the Engineers with a list of the private utility company's that have facilities located within the City. They are as follows:

  - Columbia Gas of Ohio, Inc.
    James Drozdowski, Plant Foreman
    3315 West 21st Street
    Lorain, Ohio
    (216)282-9181
    or
    R.L. Babbit
    216 Third Street
    Elyria, Ohio
    (216)323-5551

- Centel
  Lorain Telephone Company
  Harry Groene
  Engineering Division
  203 9th Street
  Lorain, Ohio 44052
  (216)244-8226

- Ohio Edison Company
  Jack H. Sevits
  Engineering Division
  6326 Lake Avenue
  Elyria, Ohio
  (216)244-1991

- City of Lorain Water Department
  Mr. Philip Maiorana, Utilities Director
  or Mario Volpe
  1106 First Street
  Lorain, Ohio
  (216)244-1000

- Mr. Arthur Manichl
  Electric Department
  City of Lorain
  1752 Hamilton Avenue
  Lorain, Ohio
  (216)244-3261

- American Telephone & Telegraph Co.
  R.A. Rublaitus
  1210 E. Bogart Road
  Sandusky, Ohio
  (419)625-3814

- County of Lorain Engineering Department
  Larry McGlinchy, County Engineer
  247 Hadaway Street
  Elyria, Ohio

WJF/TWS/dlj

WJF

cc: Rolf Simonsen, Project Manager
bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O.# 13402-00-ARA

MEETING REPORT

March 30, 1979

U.S. STEEL - LORAIN WORKS - AT HEAD OF BLACK RIVER, WEST BANK

Karl E. Kummant, Plant Engineer
Lorain-Cuyahoga Works
United States Steel Corporation
1807 East 28th Street
Lorain, Ohio 44052
Phone: 216/277-2433

Also in Attendance:

John Clarke, Plant Engineering-Construction

Representing Michael Baker, Jr., Inc.

Thomas W. Smith
William J. Flick

DISCUSSION:

- Briefly discussed the minutes of the January 31, 1979 meeting of the Corps with U.S. Steel, especially Inclusion 2, vessel unloading characteristics and Inclusions 6, 7 and 8, schemes for handling future iron ore pellet delivery's. Mr. Kummant refered the Engineers to Mr. Frank C. Haugland, U.S. Steel Corp., 600 Grant Street, Pittsburgh, PA, phone (412)433-6374, for more detailed information on the unloading characteristics of vessels. Mr. Kummant advised that U.S. Steels EXHIBIT 1 (referenced as Inclusion 6 in the Corps meeting minutes) is presently being appraised by U.S. Steel. It was agreed that the point of terminus for the Lorain Harbor Study Alternatives incorporating conveyor schemes would be just upstream from the 21st Street Bridge on U.S. Steel property. U.S. Steel's appraisal of EXHIBIT 1 will commence at this point.

- The rate of conveyance or belt speed should be capable of delivering 3,000 tons/hour. This figure is based on an annual requirement of 8,000,000 tons/year of iron ore pellets which converts to an hourly requirement of 1,050 tons; a factor of 3 having been added to assure an adequate supply of pellets.

- U.S. Steel is of the opinion that realistically only one (1) 1,000' vessel could occupy the Black River at a time.

- Referencing the January meeting minutes, Item 8, present iron ore pellet handling operations result in approximately a 5% loss to fines, Mr. Kummant went on to elaborate that in addition to a material loss, the dust blows out of furnaces creating/contributing to air pollution and also retards heat transfer. Therefore, it is extremely important that the number of times the material is handled be kept to a minimum and in the case of a conveyor system, the number of transfer points should be minimized. As to the actual percent of pellets lost to fines, the amount is not readily quantifyable.

- Weight of iron ore pellets is estimated at 148.7#/cf by U.S. Steels Accounting Department.

- The Engineers inquired if a specific conveyor manufacturor had been identified in U.S. Steels appraisal of EXHIBIT 1. Mr. Kummant said no, but that Dravo had manufactured the new conveyor to the lime plant and the Jervis Webb Company had been responsible for the manufacture of the most recent conveyor additions to the pellet handling system. For further information, Mr. Kummant suggested that the Engineers contact Mr. Haugland in Pittsburgh.

- In general, a ground level conveyor is preferred due to the fact that it offers accessability for maintenance and repair.

- U.S. Steel advised of the existance of the following utilities near the 21st Street Bridge:

  - City Sewer, west bank
  - High Voltage Power Line, over river
  - City Waterline, under river

  There are no U.S. Steel utilities in the vacinity of the bridge.

- U.S. Steel indicated that there was a potential for physical plant expansion to the east bank of the river with accompaning docking facilities.

- Concerning U.S. Steel cooperating with Republic Steel on the operation of a transshipment facility at the lake front, Mr. Kummant stated that this is a possibility.

- As an alternate to a conveyor, the Engineers posed the possibility of utilizing the unit train concept to deliver iron ore pellets from the lake front. Mr. Kummant advised that the primary disadvantage of such a scheme would be rail traffic congestion at U.S. Steel and secondly, the

plants entire system for receiving iron ore pellets is river oriented. Finally, Mr. Kummant is familiar with the potential problems inherent in a rotary dumper (coal is shipped to Lorain by rail and unloaded with a rotary dumper) and from an operations standpoint has a decided preference for a conveyor over a dumper.

- The depth of water at U.S. Steels docks is approximately 24'. Dredging below this depth to accomodate 1,000' vessels would undermine the dock. Therefore, if 1,000' vessels could navigate to the 3 mile mark, U.S. Steel would install cells off the face of the existing docks and add a land side conveyor that could reach out to the vessels to accept deliverys.

- Mr. Kummant explained that if a transshipment facility were to become a reality, U.S. Steel would probably initiate the development of a special purpose vessel to transport material from the lake front (possibily via direct transfer from Great Lakes vessel) to U.S. Steels docks and self unload. The special purpose vessel would have a capacity on the order of 20,000 tons (presumably a Class V or VI vessel) and would have the ability to sail the open lakes. Mr. Kummant suggested the Engineers contact American Ship Building for a price for such a vessel. In Mr. Kummants opinion, a special purpose vessel would be far superior to a conventional barge and tug operation such as that employed on the Ohio River.

- The engineers inquired with reference to getting in contact with the U.S. Steel fleet, especially the Captain of the Roger Blough. Mr. Kummant refered all questions concerning operation of the fleet to:

  Mr. David G. VanBrunt
  1707 North 7th Ave., East
  Duluth, Minnesota 55812
  Phone: 218-728-2222

- Mr. Kummant indicated that U.S. Steel owns all the land in the vicinity of the upper turning basin that would be needed for enlarging the same.

- Mr. Clarke provided a map showing U.S. Steel property boundaries along the Black River.

TWS/WJF/dlj

WJF

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GKJ, ~~TWS~~, ELW/WJF

MEETING REPORT

March 29, 1979

TERMINAL READY MIX - ABOVE N&W RR BRIDGE EAST BANK

Mr. Sam Falbo
Terminal Ready Mix
524 Colorado Avenue
Lorain, Ohio
Phone: (216)288-0181

Representing Michael Baker, Jr., Inc.:

William J. Flick
Thomas W. Smith

DISCUSSION:

- Mr. Falbo stated that Terminal Ready Mix has approximately 12 acres of land. The portion of his land near the river is founded on solid shale and only about 5 feet higher than the mean water level of the river.

- When the new vertical lift bridge was built, Terminal Ready Mix sold the railroad 1/5 of an acre of land adjacent to the bridge for $35,000.

- Terminal Ready Mix's only need as far as improvement to the river is additional dredging near their dock.

- Their dock is protected by sheet pile which was driven about 10 years ago. The sheet piling (the straight web type) was driven about 10 feet to the shale layer.

- Terminal receives sand and stone at their dock. Sand is brought in by a sandsucker (approximately 350 feet long) owned by the Erie Sand & Steamship Company. They receive 5-7 loads per year at 3,500 S.Y./load. Sand is unloaded by Terminal Ready Mix conveyors. Stone is brought in from Marblehead Stone Company in Ohio. Previously (a few years ago), #57 and #67 (OhioDOT) stone had been shipped in on U.S. Steel vessels, like the Calcite, but due to increased shipping costs stone is currently being brought in by truck from Sandusky, Ohio. Terminal will continue to truck aggregate until it is no longer cost effective, at which time, they might use great lakes vessels to deliver stone.

- o All vessels delivering aggregate to Terminal's dock must be self-unloaders. Conveyors typically have reaches of 225-250 feet.

- o Occassionaly, due to insufficient water depth at Terminal's dock, vessels delivering stone have been forced to partially unload in order to allow vessel to get closer to the dock for the remainder of unloading.

- o Mr. Falbo also noted that just up river steel piles were driven roughly 50 feet till they hit solid ground.

- o Often when the larger vessels with bow thrusters are maneuvering on the river, he said that resulting waves of about 2-3 feet can partially inundate their dock.

- o The Engineers advised that an information workshop will be held in Lorain latter this spring; an invitation is to be sent to Terminal Ready Mix, attention Sam Falbo, Jr.

WJF/TWS/dlj

WJF

c: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O.# 13402-AR4

MEETING REPORT

March 29, 1979

ARMY CORPS OF ENGINEERS DREDGE HOFFMAN - PRESENTLY WORKING BLACK RIVER

Officers on Board:

2nd Mate George Thoreson
3rd Mate Charles Lampman

Representing Michael Baker, Jr., Inc.

Thomas W. Smith
William J. Flick

DISCUSSION:

The Engineers initiated a visit to the Hoffman while it was discharging dredged material into the diked disposal area. The purpose of the visit was to get a first hand accounting of navigation problems on the Black River. The Officers invited the Engineers to remain on board for the run up to the 3 mile mark to the area where they were presently dredging. The Engineers accepted the invitation and were afforded a water level view of the Black River channel.

216 40' beam

The Hoffman is 200± feet in length and the officers experience no difficulty's in navigating the river. However, the limited clear opening under the Erie Avenue bridge was readily apparent. The 3rd Mate noted that due to the intermittant rain that had been occuring over the last 24 hours, the current had picked up significantly but still presented no problems to the Hoffman. But, as the 3rd Mate made his approach to the bow mooring pier and lowered the speed to less than 1 knot, the current acting on the Hoffman moved the stern quite noticably out into mid-channel.

While passing the 730' Middletown anchored at the lower turning basin, the 2nd Mate stated that he thought this vessel was a converted World War II tanker. The vessel's bow thruster portal was approximately 5' in diameter. The 2nd Mate went on to state that he believed the unloading rate of a 27,000 ton iron ore vessel such as the Middletown was 6 hours if it was a self unloader and 10 hours if Huletts were used (3 units working simultaneously such as those located at U.S. Steels dock).

The Hoffman is a hopper type dredge with 2 suction pipes 24" in diameter. Since open lake dumping from the Black River

is presently undesireable, the dredge discharges its contents into the diked disposal area through its 18" diameter discharge pipe. The dredge will be working 24 hours a day in the Black River until mid-April.

TWS/WJF/dlj

WJF

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O.# 13402-ARA

MEETING REPORT

March 29, 1979

GRIFFITH BLACKTOP, INC. - UPPER TURNING BASIN, EAST BANK

Mr. Earl Griffith, President
Griffith Blacktop, Inc.
32nd and Omaha Avenue
Lorain, Ohio
Phone: (216)233-6104

Representing Michael Baker, Jr., Inc.:

William J. Flick
Thomas W. Smith

DISCUSSION:

- Mr. Griffith explained that they have two (2) dock facilities. The first is located near the lower turning basin downstream of the 21st bridge on the east bank. The second is on a parcel of land leased from United States Steel at the upper turning basin on the east bank adjacent to National Gypsum.

- Mr. Griffith indicated that all of the U.S. Steel fleet excepting the 1,000 footers, dock at his two (2) facilities.

- Griffith Blacktop receives only shipments of stone and sand. They received 330,000 tons of stone in 1978. About 89% of Griffith's paving work is for Federal and State highways and therefore his business fluctuates along with the road building industry.

- Sand shipments are brought in by two sand barges (sandsuckers). The one owned by Captain Tom Lyons unloads sand at the lower dock almost daily during the shipping season. The other sandsucker (the M/V John R. Emery) is owned by Erie Sand Streamship Company. NOTE: M/V stands for motor vessel.

- The stone is bought from Cedarville, Michigan, (Ohio?) and shipped out of Marblehead, Ohio. The Columbia (625 feet long) is the longest vessel that can be loaded at Marblehead. Thus, Mr. Griffith does not feet that his company will ever need the ability to dock the 1,000 footers.

- Even if a conveyor/transsshipment facility is constructed, shipment of stone and sand by vessels directly to Griffiths docks would still be the most desireable method of delivery.

- When informed of the various alternatives for the Lorain Harbor, Mr. Griffith said that he was not in favor of a tunnel to replace the Erie Avenue Bridge because it would fix the maximum channel depth at that point.

- Other owners along the river, north of Kramers boathouse, are:

  Bill Virgin - runs a diving company
  Victor Montz - contractor for breakwall construction, etc.

- Mr. Griffith stated that there are only two major problems with navigating the Black River:

  - Erie Avenue Bridge is too narrow

  - 21st Street Bridge is too low

- The land area upstream from Terminal Ready Mix was owned by the Lorain-Elyria Sand Company (LESCO), but was purchased by Mr. Carl Adams. The 14 acres of property sold for $1,000,000 or $71,500/acre.

- The Great Lakes Towing Company which was located below the Erie Avenue Bridge on the West bank is not there any more.

- The Chessie System (B&O) has a local office at 36th and Fulton Avenue.

- Mr. Griffith was under the impression that the firm of Johnson & Johnson had been retained as Construction Managers by Republic Steel to supervise construction of their proposed transshipment facility.

WJF/TWS/dlj

WJF

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O.# 13402-ARA

MEETING REPORT

REPUBLIC STEEL CORPORATION
Cleveland, Ohio

Date: March 27, 1979

In Attendance:	Pat Manley	-	Republic Steel
	Max Janairo	-	Michael Baker, Jr., Inc.
	John Kurgan	-	Michael Baker, Jr., Inc.

Discussion:

Republic Steel has purchased approximately 90 acres in Lorain for use as an ore transhipment facility. The property is located on the west bank of the Black River north of Erie Avenue and frontage along the west bank south of Erie Avenue.

Vessels to be used there will all be equipped with self unloaders. The material will be railed to Republic's Youngstown works and shipped to their Cleveland works. Ships will be 638' X 68'. (?)

In their site explorations they discovered the shale depth was not uniform throughout and in some areas was 60' deep.

A problem of the deterioration of the federal pier cribbing was noted. This is probably due to propeller wash and thrusters. Mr. Manley explained that they have found that dock walls were constructed for 21 foot channel depths and not for the existing 27 foot channel. Therefore, the channel banks slope so that close docking is impossible.

GJK:mk

cc: Rolf Simonsen, Project Manager

bc: MBIII MRJ GJK TWS ELW/WJF
S.O. #13402-00-ARA

MEETING REPORT

CITY OF LORAIN, OHIO
DIRECTOR OF UTILITIES

Date: March 27, 1979

In Attendance:			
	Philip Q. Maiorana	-	City of Lorain, Director of Utilities
	Max Janairo	-	Michael Baker, Jr., Inc.
	John Kurgan	-	Michael Baker, Jr., Inc.

Discussion:

The Lorain Director of Utilities is responsible for water and sewer service.

Water Service. The effects of the port development project on water service are as follows.

- Water lines cross the Black River north of the Erie Avenue bridge via a siphon-tunnel. The tunnel is not very deep and would restrict any deepening of the channel.

- Due to environmental regulations the City will be extending their lake water intake approximately one mile from shore. The current primary intake will remain as a secondary source. An intake existing within the harbor will be removed. The City will be able to provide Michael Baker, Jr., Inc. with estimates of the associated costs within a week.

Sewer Service. Effects on sewer service follow.

- A new siphon-tunnel is being constructed for the sewer crossing of the river channel in the area north of Erie Avenue. Currently the crossing is in the same tunnel as the water line. The new tunnel will be much deeper and safe from the effects of channel deepening. Estimated costs for lowering the sewer line are $1.5 million.

- Sewer lines entering the sewage treatment plant from the east are already on siphon located along Lakeside Avenue at the City Park. The tunnel is not wide enough to span a relocated river entrance through the park.

- In general, the problems of the existing sewage treatment plant were discussed. Because of its location underground pipes are under the water table, making maintenance and repairs difficult. A desire to relocate was expressed.

GJK:mk

cc: Rolf Simonsen

bc: MBIII MRJ GJK TWS ELW/WJF
S.O. #13402-00-ARA

MEETING REPORT

U.S. COAST GUARD
Cleveland, Ohio

Date: March 27, 1979

In Attendance:	Commander Martin	- U.S. Coast Guard, Search & Rescue
	Bob Bloom	- U.S. Coast Guard, Bridge Branch
	Fred Miesev	- U.S. Coast Guard, Bridge Branch
	Max Janairo	- Michael Baker, Jr., Inc.
	John Kurgan	- Michael Baker, Jr., Inc.

Discussion:

Coast Guard Station. There are no plans to close the Lorain station. It is located along that stretch of Lake Erie to provide evenly spaced protection between neighboring stations. The services are oriented primarily toward recreational boating. It can be expected that there would be opposition to the closing of the station. The Coast Guard would prefer to remain in the existing location but could be relocated. It was estimated that 1.5 acres would be required to house a Coast Guard Station for 15-25 men.

Bridges. Pier fendering is currently not required by law although it is typically requested by the Coast Guard as a safety measure. Future legislation could make it mandatory, however.

There are no regulated bridge clearance requirements. Clearances are reviewed on an individual basis and permits granted according to the traffic anticipated under the bridge. Accepted seaway clearance is currently 120' high. However, due to the growth in vessel size seaway clearance may soon increase to 125' high.

GJK:mk

cc: Rolf Simonsen

bc: MBIII MRJ GJK TWS ELW/WJF
S.O. #13402-00-ARA

MEETING REPORT

CITY OF LORAIN
ENGINEERING DEPARTMENT

Date: March 26, 1979

In Attendance:	Ray Henry	-	City Engineer
	Lowell Kneisel	-	Engineering Department
	Paul Shulsky	-	Engineering Department
	Max Janairo	-	Michael Baker, Jr., Inc.
	John Kurgan	-	Michael Baker, Jr., Inc.

Discussion:

The value of 12 acres of land owned by the City in the marsh area at the Henderson bridge is valued at approximately $130,000.

A 45-foot deep utility tunnel crossing the river north of Erie Avenue is scheduled to be reconstructed. It contains sewer, telephone and water lines. A brand new tunnel is also scheduled to be constructed in the same area.

The river bottom is predominantly shale. Storm sewer outlets exist along the river in the area of the lower turning basin, the railroad bridge and the Henderson bridge.

GJK:mk

cc: Rolf Simonsen

bc: MBIII MRJ GJK TWS ELW/WJF
S.O. #13402-00-ARA

MEETING REPORT

CITY OF LORAIN
DEPARTMENT OF COMMUNITY AFFAIRS

Date: March 26, 1979

In Attendance:	Sandy Prudhoff	- Dept. of Community Affairs
	Pete Schroeder	- Dept. of Community Affairs
	Frank Detillio	- Dept. of Community Affairs
	Rick Novak	- Dept. of Community Affairs
	Max Janairo	- Michael Baker, Jr., Inc.
	John Kurgan	- Michael Baker, Jr., Inc.

Discussion:

The Department voiced strong feelings against any alternative to port development that would close or affect the downtown area. An alternative that would straighten the Erie Avenue bridge to be perpendicular with the river was most appealing. The Erie Avenue bridge is operated by the County. The City will attempt to obtain Federal funds via the 1978 Surface Transportation Act to construct a new drawbridge at Erie Avenue. They will be proceeding with this effort shortly.

Estimated land values may be available via the County. Average land values are difficult to identify, however. They are highly dependent upon the owner.

GJK:mk

cc: Rolf Simonsen

bc: MBIII MRJ GJK TWS ELW/WJF
S #13402-00-ARA

MEETING REPORT

LORAIN PORT AUTHORITY

Date: March 26, 1979

In Attendance: John Sulpizio - Lorain Port Authority
Max Janairo - Michael Baker, Jr., Inc.
John Kurgan - Michael Baker, Jr., Inc.

Discussion:

Idealistically, the Port Authority would prefer that the Port of Lorain would be improved to accommodate 1000' vessels for the entire 3-mile channel. Reasons include:

1. Channel improvements would be cheaper for industries than a transhipment facility;

2. American shipbuilding will still require the channel to accommodate 1000' vessels;

3. Transhipment facilities will tie-up otherwise developable land;

4. There are economic advantages to American shipbuilding to encourage the use of 1000' vessels, including repairing and retrofitting of them; and

5. There is potential that National Gypsum could benefit from 1000' vessels.

The Port Authority is currently considering constructing a marina as a demonstration project. Current thinking is to provide a marina facility that would have a high degree of flexibility and recovery. This could be done by using a scrap freighter as a breakwater. This could eventually be relocated to comply with Corps of Engineers plans. Marina demands have been based on waiting lists for existing marinas in the area.

There is currently a six-month long strike at American Shipbuilding. Settlement of the dispute could affect the future of that industry.

There is a move to diversify the commodities currently shipped through the port. This could increase the total flow of material through Lorain.

GJK:mk

cc: Rolf Simonsen

bc: MBIII MRJ GJK TWS ELW/WJF
S.O. #13402-00-ARA

RESOURCE AND ENVIRONMENTAL PLANNING DEPARTMENT

TELEPHONE CALL REPORT

PROJECT: Lorain Harbor Study for the Buffalo District Corps of Engineers

DATE: 3/26/79

A.M. 10:30 P.M.

LOCATION: Lorain, Ohio

TO: J.R. McCandless

FROM: Mr. Steve Oddam

REPRES.: MBJR., INC.

REPRES.: U.S. Fish & Wildlife Service (Columbus, Ohio)

SUBJECT: F&WS Four Season Study

DISCUSSION:

Mr. Oddam called to discuss his work and findings to date on the Lorain Harbor "four season study." The study was recommended by the Fish & Wildlife Service office in Lansing, Michigan. That office originally had jurisdiction over the Lorain Harbor but because of internal reorganization the office was closed. There was major concern about the Lorain Harbor Improvement Study in view of the general lack of knowledge of fisheries and wildlife utilization in the area.

There is an October 1 deadline on the study and at the present there is not much in the way of identifiable results. Mr. Oddam did indicate a concern for moving or altering the mouth of the river which could adversely affect the fish during spawning runs.

Mr. Oddam and I have agreed to keep each other informed of developments as they become available. I will keep him informed about the development and changes to the alternatives and he will keep me informed as to their findings relative to fish and wildlife resources.

Mr. Oddam mentioned that he had heard that there is another steel producer considering moving from the Cleveland Harbor area to the Lorain Harbor area. Are we aware of this? If not, this could be an additional consideration in the planning and feasibility studies.

cc: CF CIH/JCH/A-FILE MRJ ~~ELW~~ JRMc GJK

S.O.# 13402-01-ARA

RESOURCE AND ENVIRONMENTAL PLANNING DEPARTMENT

TELEPHONE CALL REPORT

ROJECT: Lorain Harbor Study for Buffalo District, Corps of Engineers

DATE: 3/23/79

A.M. 11:00 P.M.

LOCATION: Lorain, Ohio

TO:

FROM: J.R. McCandless

REPRES.: U.S. Fish & Wildlife Service

REPRES.: MBJr., Inc.

SUBJECT: Agency Contact

DISCUSSION:

I first called the North Central Regional Office in Twin Cities, MN and talked with Mr. Don La Pointe (612/725-3536) who explained that he was vaguely familiar with the project but that I should speak with the people in their Columbus, Ohio Field office for the details.

I then called Mr. Conrad Fjetland in their Columbus office. Mr. Fjetland was out but I talked with Mr. Ken Lammers (614/231-3416). Mr. Lammers informed me that their office is in the process of conducting a "Four Season Study" on the Black River as it relates to the Lorain Harbor improvements. Mr. Lammers indicated that a Mr. Lynn MacLean and Mr. Steve Oddam (both unavailable) were conducting the investigation which was initiated in the Fall of 1978 and should be completed by the Fall of 1979.

The overall procedure as it was explained to me is as follows:

1. the four season study is completed by the Fish and Wildlife Service to identify and document the fish and wildlife resources and utilization of the habitat,

2. they submit a report to the Corps,

3. the Corps then provides the F&WS with the alternative improvements for consideration, and

4. the F&WS reports back to the Corps on what they feel the effects of the various alternative treatments would be to the fish and wildlife resources and which alternative they prefer.

Either Mr. MacLean or Mr. Oddam are to call me on Monday (3/26/79) to further discuss this project.

cc: CF CIH/JCH/A-FILE MRJ ~~ELW~~ JRMc

S.O.# 13402-01-ARA

MEETING REPORT

March 22, 1979

ALLIED OIL COMPANY - ABOVE 21st ST. BRIDGE, EAST BANK

Jim Ross, Chief Engineer
Allied Oil Company
Division of Ashland Petroleum Company
Suite 1000
1 Erieview Plaza
Cleveland, Oh 44114

Also in attendance:

Clint Goodwin, Executive Vice President
Cleveland Tankers, Inc.
Division of Ashland Petroleum Company
Suite 1000, etc.
and
John Joeckel (Pronounced Yea·Coal)
Marine Superintendent
Cleveland Tankers, Inc.

Representing Michael Baker, Jr., Inc.

Thomas W. Smith
William J. Flick

DISCUSSION:

- Allied Oil Transports oil in vessels with a top size of 400'-450' (w/60' beam and drafts of averaging 20'-22' with a 23' maximum draft). Presently, they experience no extraordinary difficulties in navigating the Black River.

- After advising them briefly of the 10 alternatives proposed by the Corps, their only area of concern was traffic control. They foresee a substantial amount of congestion with 1000' vessels in the harbor and wondered if some agency would be designated to be responsible for traffic control. Presently, their tankers are not experiencing traffic problems in the Black River.

- Allied/Cleveland Tankers are not anticipating a shift towards larger vessels. Apparently port restrictions where the loading occurs have dictated their fleet size.

- The only problem that they are experiencing with Lorain Harbor is that they require some dredging in the vacinity of their docking cells. In some locations, the depth is only 17' to 19' and they prefer a 23' depth.

- Their travel in the river is as fast as conditions will permit with a top speed of approximately 6 knots.

- Allied has unusually good bank conditions due to a shale outcropping that extends from the 21st Street bridge up to the cell dock area.

- Twelve (12) vessels per year deliver fuel oil to Allied's Terminal in Lorain Harbor. This is approximately 2 vessels/month. Total time elapsed per each delivery including the unloading of the cargo is 7-8 hours, 10 hours at the most.

- All oil shipments generally are made from about April to November.

- Mr. Joeckel offered the following suggestion: send a questionnaire to all of the vessel masters who regularly navigate the Lorain Harbor and get their individual opinions.

- In general, due to the size of vessel that Allied Oil employs to deliver fuel oil to Lorain, the Harbor has good access and presents no problems. Their main concern is that any improvements to the Harbor do not adversely affect their vessels.

- They indicated that their vessels will not enter the opening in the breakwaters during very dense fog conditions.

- Also, navigation of the oil tankers past the west pier with a 1000' vessel at the dock would be very difficult since the channel is only 250' wide.

- They were most enthusiastic about a transshipment facility because it would confine the larger vessels to the outer harbor and leave the river clear for the smaller boats.

- In the Black River, tugs are not required, to assist Cleveland Tankers 400'-450' vessels.

- At the conclusion of the meeting, Cleveland Tankers again emphasized the future need for traffic control.

- The Engineers advised that an information workshop would be held in Lorain later this spring; the invitation is to be sent to Jim Ross who will distribute it through his organization.

WJF/TWS/dlj

WJF

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O.# 13402-00-ARA

MEETING REPORT

March 22, 1979

AMERICAN SHIP BUILDING COMPANY - ABOVE ERIE AVENUE BRIDGE, EAST BANK

Mr. Richard Mayr, President
The American Ship Building Company
400 Colorado Avenue
Lorain, Ohio
Phone: 216/288-1234

Also in Attendance:

Gavin Sproul, Vice President/Engineering
Gordon Stafford (sp)

Representing Michael Baker, Jr., Inc.:

Thomas W. Smith
William J. Flick

DISCUSSION:

o American Ship Building explained how they use the Black River:

Ship Building

After the basic vessel has been constructed, it is moved into the inner harbor for outfitting. If the ship is a smaller sized vessel, it will be positioned along the east bank, between the Erie Avenue Bridge and their two (2) dry docks. If it is a larger vessel, then it will be positioned in front of the dry docks. Drydock No. 1 currently can handle a maximum vessel size of 1000'x105'. Drydock No. 2 can handle a maximum vessel size of 730' but could be expanded to accommadate 826' vessels.

All 1000' vessels to date have been equipped with self unloaders.

Vessel Maintenance and Repair

If a dry dock is not available, the vessel is usually tied to the pier that is parallel to dry dock No. 2 along the east bank and just south of the N & W RR bridge. Occasionally, two (2) vessels will be stored in this location side by side and as a result, the second vessel encroaches upon the inner harbor. However, vessel maintenance is scheduled November through May whenever possible (i.e. during the

winter months when the Great Lakes are ice bound) and the vessel traffic up the Black River is at a minimum.

- If American Ship Building would have one vessel, 700' class or greater, tied below the RR bridge, a 1000' vessel could not pass due to the physical constrictions of the RR bridge.

- To their knowledge, the 768'-3"x72' Munson, one U.S. Steel's Great Lakes Fleet, has been the largest vessel to date to sail up the Black River to the upper turning basin.

- American Ship Building presented a brief slide show of the exodus of the 1000' James R. Barker when it left the inner harbor. Six (6) tugs were utilized with a shore captain in charge. At times, the sterns of the tugs were against the banks of the river. The primary concern of American Ship Building was physical clearance through the Erie Avenue Bridge. The face to face measurement between peirs is 294.167 feet, but the bridge is skewed with respect to the river channel. When open, the leafs of the bridge encroach upon the navigable waterway. At elevation 668.926, 118.43' above low water elevation 570.5, the critical point of clearance for the passage of the Barker, the actual clear measurement is 137.50 ft. (147.50 ft. is the leaf to leaf distance). The passage through the bridge was conducted with a 20' light water draft on the Barker.

- The future growth of American Ship Building facility will be along the east bank into the property between the Erie Avenue bridge and dry dock No. 1. American Ship Building presently holds title to this land.

- Class VI vessels and below can turn in the lower turning basin; Class VII vessels must use the upper turning basin.

- Thrusters in the Barker are 1500 HP; shaft or tunnel diameter is approximately 8'-9'.

- Deepest vessel draft is 28' (27'-10").

- The 730' Middleton is tied-up at the lower turning basin now.

- Vessel dimensions:

Length		Beam		Draft		Vertical Height above water
1000'	X	105'	X	28'	X	115'
1200'	X	130'	X	28'	X	130'

- In concluding the meeting with American Ship Building, the Engineers advised that an information workshop would be held in Lorain later this spring. The American Ship Building Company wishes to be in attendance; the notice is to be sent to Mr. Mayr.

WJF/TWS/dag

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O. #13402-00-ARA

PHONE CALL REPORT
March 19, 1979

NATIONAL GYPSUM - ABOVE 21st ST. BRIDGE, EAST BANK

Mr. Clair A. Lawton
General District Manager, Midwest
Gold Bond Building Products Division
National Gypsum Company
2001 Rexford Road
Charlotte, NC 28211
Phone: 1-800-438-8410

Initially contacted Mr. Scheu with the National Gypsum Company in Lorain, OH. Mr. Scheu referred the writer to Mr. Lawton in the Charlotte office who handles lake shipping.

Contacted Mr. Lawton with the intention of setting up a meeting to obtain input from the National Gypsum Company. The information inparted by Mr. Lawton was such that the writer determined a meeting was not necessary at this time.

Mr. Lawton's comments were as follows:

1. The Lorain facility receives a maximum of approximately 20 cargo shipments per season.

2. The largest vessel handling gypsum ore in Lorain Harbor is the 634' Sam Laud.

3. The volume of gypsum ore expected to be delivered to Lorain in 1979 is 180,000 tons and it is projected that this volume will be delivered by 16-17 vessels.

4. National Gypsum Company obtains their gypsum rock at Port Gypsum, Michigan and it is shipped to Lorain and also to Buffalo, New York.

5. National Gypsum does not anticipate any increases in the tonnage shipped from Michigan or in the tonnage required at Lorain or Buffalo for the following reasons:

    a. Port Gypsum will not accommodate any vessels larger than the 634' Sam Laud.

    b. The Lorain & Buffalo Plants are operating at full capacity and National Gypsum has no plans to enlarge these plants.

c. The gypsum business is stable; significant growth is not projected at this time.

6. The shipping season from Michigan to Lorain usually extends from April to November.

7. The vessels delivering gypsum ore to Lorain are all self-unloading.

8. The only problem National Gypsum has with the Lorain Harbor (and Mr. Lawton gave the impression that the problem is minor) is that some dredging is needed in the vicinity of their unloading dock.

In concluding the conversation with Mr. Lawton, the writer advised that an information Workshop would be held in Lorain later this Spring. Mr. Lawton stated that he wished to be in attendance, representing the National Gypsum Company.

William J. Flick

William J. Flick, P.E.

WJF/dag

cc: Rolf Simonsen, Project Manager

bcc: MBIII, MRJ, GJK, TWS, ELW/WJF
S.O. #13402-00-ARA

MEETING REPORT
LAKE CARRIER'S ASSOCIATION
CLEVELAND, OHIO - MARCH 14, 1979

In Attendance:

Robert Braybender	-	Vessel Master		
Leonard Olsen	-	"	"	
Eldon Allan	-	"	"	
Vic Anderson	-	"	"	
Dave Buchanan	-	Lake Carriers Association		
Jim Beers	-	North Central District, Corps		
Rolf Simenson	-	Buffalo District, Corps		
Jim Henry	-	"	"	"
Dick Gierecki	-	"	"	"
Michael Pelone	-	"	"	"
Max Janiero	-	Michael Baker, Jr., Inc.		
John Kurgan	-	"	"	"
Bill Flick	-	"	"	"

Discussion Related to Loraine Study

Operating Characteristics of 1000 Foot Vessels

Vertical and Horizontal Movements. The height of vessels ranges from 97' to 115'. Channel depth is defined at low water datum. Squat does not occur when the vessel is moving slowly. Roll of the vessel is the greatest concern. If there is greater than one degree or more of roll not many vessels will enter the harbor. Rolling is typically due to wave action.

Speeds and Stopping Distance. Weather and traffic usually determine the speed at which vessels enter a harbor. Required stopping distances in the harbor are unique to each vessel and the weather conditions. Generally, however, at a typical speed of four miles per hour 500 feet of stopping distance is required. Often anchor dragging is used to help in stopping.

Turning. It is typically not a problem to pivot and swing into a dock area. Over 20 miles per hour of wind may make it difficult and tug assistance could be required. Tugs are not very effective and they are seldom called upon if they can be avoided.

Winds/Prohibitions to Harbor Entrance. If northerly winds are greater than 30 miles per hour, the vessel master would not enter a harbor.

Lorain Harbor Entrance

Obstacles. The west breakwater and light restrict the harbor entrance. It was suggested that 500 or 1500 feet of the west breakwater be pivoted to the west, thus allowing for a less narrow and straighter entrance of vessels.

Weather Restrictions. At 15 miles per hour winds there is no problem with harbor entry. Under ideal conditions the harbor can be entered stern first.

Harbor Depths. A 29 foot harbor depth is sufficient up to wind conditions of 25 miles per hour. These depths are sufficient also for operating and turning light while under ballast. Under existing conditions, the shallow depths of the east harbor area restrict complete turning of vessels in the outer harbor. This section needs to be dredged.

Harbor Alternatives. Two alternatives were listed:

1. pivot 500 feet of the west wall to the west and dredge the east section of the harbor;

2. pivot 1500 feet of the west wall to the west and do not dredge any of the harbor area for turning.

Relocating the outer breakwater and east breakwater would not provide much relief to the constricted entrance problem. It was also mentioned that these breakwaters were relatively new.

River Channel

Manueverability. The primary problem with large vessels making turns in the Black River is that they temporarily dam or block the river. While in a tight turn, water begins to build up or pond ahead of the vessel and at the same time the water level in the channel behind the ship begins to drop. As this non-uniform flow condition develops, the water surface at the stern of the vessel continues to drop and at the same time the velocity of the stream increases. The net result is that the stern begins migrating towards the near bank, taking the path of less resistance. The longer the period of time required for the vessel to make a sharp turn in the narrow channel, the more profound and dangerous this situation becomes.

For turning 1000 ft. vessels 180°, a minimum of 100 ft. clearance is desirable at both ends of the ship for a total turning area of 1200 ft. diameter. (Presumably, a 1200 ft. vessel will require a turning area of 1400 ft. diameter to make a 180° turn).

Cut No. 1. Cut No. 1, proposed by the Corps on the west bank, just upstream from Erie Avenue Bridge, was considered to be very desirable by the Vessel Masters. This would aid navigation not only for the newly built vessels leaving the docks of the American Ship Building Company, but would benefit all of the vessels that must enter the docks for maintenance, repair and inspections.

Erosion. Bow and stern thrusters (1600 to 1800 HP) promote stream bank erosion. In the opinion of the Vessel Masters, the existing applications of rip-rap along river channels have not been adequate, possibly the top size is too small, and they regard steel sheet piling to be the only positive method of stream bank protection.

The Vessel Masters felt there was a need to stabilize most of the Black River Channel in addition to improving the turns as well. Their recommended cuts along the channel are noted on the attached sketch.

Blocking of Channel. An added problem to navigation is that the American Ship Building Company occasionally double stack vessels along the river, which

then encroach upon the Inner Harbor.

Tugs.

a. It is expensive to use tug assistance; need 6-8 tugs to handle a 1000' vessel.

b. Existing tugs have not been constructed with sufficient horsepower to handle 1000' vessels.

c. Sometimes tugs will get a vessel into trouble.

d. The advent of thrusters has caused a decline in the tug industry and tugs are not always available.

e. Tug boat captains and crews are sometimes uncooperative--that is, will not make themselves available on a moments notice and consequently create time delays of up to 2-3 days.

Channel Currents. The river current after a rain will approach 6 knots, which makes river navigation nearly impossible.

1000' Vessels Characteristics in Black River. Squat is not a problem at low speeds. As vessels increase in length, it becomes necessary to construct the superstructure higher. Spars with operating or running lights are constructed with hinged joints for lowering.

When vessles are light, drafts range from 22.0' to 24.5'.

Recommendations. The Vessel Masters recommended:

a. Erie Avenue Bridge be reconstructed as a fixed structure with adequate seaway clearance.

b. Channel widened to 250' for approaches (up & down stream) to railroad bridge.

c. Clearance on 21st Street/Henderson Avenue Bridge be increased to 117' or greater.

If 100% of the Vessel Master's recommended improvements are made to the Lorain Harbor (refer to the attached sketch), it is estimated that 1000' vessel could make the trip from the breakwater to the 3 mile mark on the Black River in approximately 3 hours.

Even with improvements, the Black River Channel could only accommodate one (1) 1000' vessel at a time.

PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS
ON
LORAIN HARBOR
OHIO

APPENDIX B

ECONOMIC EVALUATION

(Revised April 1981)

APPENDIX B

ECONOMIC EVALUATION

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ECONOMIC EVALUATION

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ECONOMIC EVALUATION

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FIGURES

LORAIN HARBOR, OHIO

PRELIMINARY FEASIBILITY REPORT

APPENDIX B

ECONOMICS

B1. INTRODUCTION

B1.1 Gen

Lorain Harbor ... ated on the south shore of Lake Erie about 25 miles west of Cleveland, ... and 90 miles east of Toledo, OH. The harbor consists of a lake approach channel, an outer harbor, and a navigation channel in the Black River which extends about 3 miles upstream.

The economic vitality of Lorain, OH, and the surrounding communities is heavily influenced by the U. S. Steel Corporation, which operates an integrated steel plant at the upstream limit of navigation in the Black River. This plant evolved from the National Tube Company originally established at Lorain, OH, in 1894. Railroad connections to the harbor, which were initially constructed to provide an outlet for coal trains that originated from southern Ohio also reinforced regional economic growth. U. S. Steel Corporation and the American Shipbuilding Company, the two largest employers in the city of Lorain, are also located along the Black River adjacent to the Federal project.

Lorain Harbor ranked as the fifth largest harbor on the south shore of Lake Erie in 1977. Total commercial activity at the harbor in 1977 was 6,287,000 tons and consisted primarily of iron ore and limestone receipts. A comparison of historical traffic at this harbor relative to other commercial harbors along Lake Erie is provided in Table B1. Most of the iron ore and limestone that arrived at this harbor in the past was destined for upriver docks. The relationship of iron and steel raw materials relative to total harbor commerce is included in Table B2. American Shipbuilding Company, a major shipyard operating in the Great Lakes, is also located adjacent to the Black River. This shipyard has already constructed several "super jumbo" bulk carriers which are the largest size vessels now operating on the Great Lakes.

There are now 11 bulk vessels with approximate dimensions of 1,000 X 105 feet operating on the Great Lakes with several more either under construction at Lorain, OH, or other shipyards in the Great Lakes. This trend is likely to continue for many more years as Great Lakes shipping companies upgrade their existing fleets to take advantage of the economies of scale inherent in the design and operation of the new generation of 1,000 X 105 self-unloading bulk carriers. It is expected that future needs for this vessel size may exceed 45. This conclusion was developed in the Maximum Vessel Size Study (December 1977) conducted by the North Central Division, Corps of Engineers. The actual number of maximum vessels to be built, the timing of their construction and

Table B1 - Historical Annual Traffic at Lake Erie Ports
All Commodities, 1972-1977

Year	Sandusky Harbor	Huron Harbor	Lorain Harbor	Cleveland Harbor	Fairport Harbor	Ashtabula Harbor	Conneaut Harbor	Erie Harbor	Buffalo Harbor
1968	6,921,785	2,552,666	10,624,684	23,307,504	2,163,223	8,230,520	14,350,331	1,249,518	13,851,152
1969	6,857,358	3,314,531	9,112,820	24,649,054	2,612,126	10,823,891	13,916,845	1,087,064	14,132,536
1970	5,078,007	2,942,354	8,573,098	22,857,537	2,655,458	11,925,980	15,534,433	1,092,206	13,277,145
1971	4,883,103	3,332,027	7,483,098	20,551,928	2,679,385	11,261,010	15,851,802	1,249,218	10,137,206
1972	5,612,730	3,380,742	10,173,023	23,865,810	2,913,317	12,063,864	14,683,654	1,360,244	8,448,185
1973	4,913,719	3,655,463	11,584,368	24,828,323	3,681,272	10,872,484	16,731,912	1,283,342	12,603,820
1974	4,220,604	3,325,132	9,076,890	21,933,874	2,937,601	10,852,259	16,565,435	903,187	9,576,553
1975	4,532,500	2,115,680	7,650,341	18,145,160	3,020,122	8,738,094	19,192,311	1,218,153	7,018,748
1976	5,370,083	2,855,701	7,439,113	18,167,579	2,677,023	11,700,411	16,464,534	1,157,637	11,481,716
1977	4,314,377	1,933,192	6,286,913	16,103,781	2,199,262	11,632,975	15,146,627	954,672	7,975,244

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

Table B2 -- Summary of Iron Ore and Limestone Receipts
Lorain Harbor, OH

Year	Iron Ore	Limestone	Subtotal	Total Harbor Traffic	Percent of Total
1973	5,626,470	1,738,988	7,365,458	11,584,368	64
1974	4,709,615	1,599,868	6,309,483	9,076,890	70
1975	4,337,928	1,379,981	5,717,909	7,650,341	75
1976	4,557,441	1,277,691	5,835,132	7,439,113	78
1977	3,085,136	1,235,005	4,320,141	6,286,913	69

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

designation of specific operating routes (i.e., origin-destination harbor pairs) can be affected by many exogenous variables.

There are many active docks within the Federal project limits. Two iron ore receiving docks and one limestone dock account for the majority of domestic bulk receipts in recent years. Several other smaller docks that receive refined petroleum products, gypsum rock, sand and gravel, and construction aggregates account for the remainder of the annual traffic volume. An overview of the importance of each commodity for recent years is summarized in Table B3.

Table B3 - Historical Tonnage of Major Bulk Commodities
Lorain Harbor, OH

Year	Iron Ore	Limestone	Sand and Gravel	Gypsum Ore	Coal	All Other Commodities
1966	3,529,042	709,865	513,579	94,508	1,636,170	137,819
1967	2,998,893	458,603	525,060	150,869	1,387,383	32,130
1968	4,026,139	768,858	513,850	94,964	5,146,995	73,878
1969	4,420,521	729,719	504,016	131,385	3,303,811	23,368
1970	3,421,070	1,255,077	582,014	125,616	3,127,335	61,986
1971	3,238,738	1,235,734	442,116	120,879	2,407,446	38,876
1972	4,214,292	1,372,711	410,929	168,627	3,933,568	72,896
1973	5,626,470	1,738,988	410,183	172,472	3,569,843	66,412 1/
1974	4,709,615	1,599,868	503,533	120,614	2,033,309	109,951 1/
1975	4,337,928	1,379,981	402,071	111,816	1,268,731	149,814 1/
1976	4,557,441	1,277,691	285,672	146,612	1,061,407	110,290 1/
1977	3,085,136	1,235,005	485,971	112,786	1,262,936	105,079 1/

1/ Increase since 1973 is attributed to petroleum receipts at Allied Oil Terminal.

Source: Waterborne Commerce of the United States, Part 3, Great Lakes.

B2. COMMODITY OVERVIEW

B2.1 Coal

Annual coal shipments from Lorain Harbor have declined steadily in recent years as the eastward flow of low sulfur western coal to Midwest steam coal utility plants grew in importance and as railroads began to use unit trains to move eastern coal to Great Lakes ports further west of Lorain (i.e., Toledo Harbor, OH) for shipment. Railroads also began to use coal unit trains to move the coal directly to major utility plants. The long-term decline of coal shipments from Lorain Harbor is illustrated in Table B4. The recent sale of the coal facility to a steel company has precluded future coal shipments from Lorain, OH. Therefore, no future coal shipments from the lakefront dock at Lorain Harbor are expected over the long term.

Shipments of coal from mines in Pennsylvania and Kentucky to Lorain Harbor, OH, occurred until 1978 when the lakefront dock operated by the Toledo, Lorain, and Fairport Co. and owned by the Chessie Railroad Corporation was purchased by Republic Steel Corporation as a site for their new pellet transshipment facility. Outbound coal shipments from Lorain Harbor represented a backhaul movement which was very compatible with the inbound movement of iron ore pellets unloaded at the Chessie dock near the mouth of the Black River. Class V and VI vessels (i.e., up to 699 feet in length) were responsible for moving more than 75 percent of the coal tonnage in recent years. Inland steel plants in eastern and southern Ohio and western Pennsylvania that receive unit trains of transshipped ore are also in close proximity to major eastern coal mines. The return flow of railroad cars that originally carried ore away from Lorain, OH, could now profitably return with coal bound for upper lakes ports.

B2.2 Gypsum Ore

Gypsum ore is received at one upriver dock located on the east bank of the Black River south of the 21st Street Bridge. This commodity flow began in 1959 and has increased significantly from an initial level of 63,600 tons to a peak volume of 172,500 tons in 1973. This earlier peak level is well above the 113,000 tons unloaded in 1977. Annual volumes handled at the dock are affected by national and regional fluctuations in the demand for new building construction. A historical review of annual traffic to this dock is summarized in Table B5.

National Gypsum Company in Lorain, OH, obtains their raw material from Port Gypsum, MI, which is a non-Federal port facility located adjacent to Saginaw Bay, MI. This loading facility also supplies their other gypsum plant in Buffalo, NY. Analysis of vessel sizes currently used to ship gypsum ore from Port Gypsum, MI, to Lorain Harbor indicated that the largest vessel used was a Class V (i.e., overall length between 600 and 649 feet), although smaller Class III and Class IV vessels were also used. All vessels, regardless of size, are equipped with self-unloading equipment due to a lack of shore-side unloading facilities at the Lorain Harbor dock. A distribution of vessels used to ship gypsum to Lorain, OH, is shown in Table B6.

Table B4 - Historical Coal Shipments
Lorain Harbor, OH

Year	Domestic Shipments	Canadian Exports	Total Coal Traffic
1968	4,860,797	286,198	5,146,995
1969	3,293,133	10,678	3,303,811
1970	3,074,838	52,497	3,127,335
1971	2,319,787	87,659	2,407,446
1972	3,748,008	185,560	3,933,568
1973	3,569,708	20,135	3,589,843
1974	2,015,059	18,250	2,033,309
1975	1,268,731	0	1,268,731
1976	1,061,407	0	1,061,407
1977	1,262,936	0	1,262,936
1978	815,546	0	815,546

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

Table B5 - Historical Receipts of Gypsum Ore
Lorain Harbor, OH

Year	Tonnage	Year	Tonnage
1959	63,600	1969	131,400
1960	127,400	1970	125,600
1961	111,100	1971	120,900
1962	80,900	1972	168,600
1963	101,400	1973	172,500
1964	111,100	1974	120,600
1965	101,600	1975	111,800
1966	94,500	1976	146,600
1967	150,900	1977	112,800
1968	94,900		

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

Table B6 - Historical Fleet Summary, Gypsum Ore Receipts
Lorain Harbor, OH

Vessel Size	1976	1975	1974	1973
Class 3 (500 feet to 549 feet)	24%	47%	0%	12%
Class 4 (550 feet to 599 feet)	8%	30%	70%	88%
Class 5 (600 feet to 649 feet)	68%	23%	30%	0%
Total Annual Traffic (Net Tons)	146,612	111,816	120,614	172,472

Source: Waterborne Commerce of the United States, Corps of Engineers.

Company officials have stated that the upper limit on ship sizes is constrained by physical limitations experienced during the loading cycle in Port Gypsum, MI, which cannot accommodate vessels greater than 634 feet in length. There was no indication from company officials of any short-term dock-side capital investments planned at the point of origin (Michigan) or destination (Lorain, OH). The present market for gypsum products was also characterized as stable with no significant growth prospects at this time. Low annual volumes handled at this dock is also a major deterrent to the use of the larger vessels. Therefore, forecasts of gypsum ore receipts were not developed.

B2.3 Petroleum Products

The Allied Oil petroleum storage facility became operational in 1973 and consists of two storage tanks with a total capacity of 500,000 bbls. Most of the annual tonnage consists of receipts of distillate fuel oil which has originated at either Buffalo, NY, or Toledo, OH. Occasional deliveries from refineries located in the vicinity of Rouge River or Detroit, MI, have also occurred in recent years. The majority of this oil is eventually delivered to the local Ohio Edison utility generating plant. Great Lakes tankers deliver oil to this storage area about every 3 weeks during the navigation season using vessel sizes that vary from 340 to 430 feet in length with an average capacity of 55,000 bbls. This is equivalent to about 7,200 net tons per trip. Cleveland Tankers, Inc. currently provides the transportation services to this dock using the fleet shown in Table B7.

Interviews with company officials during the Stage I planning investigations (Reconnaissance Report - revised January 1979) concluded that there were no significant difficulties in navigating the existing Federal project. The largest tanker size currently in use is 430' X 65' X 23'0". No long-term increase in tanker dimensions is anticipated at Lorain Harbor since vessel sizes are now physically constrained at the ports of origin. No capital improvement programs at the origin docks have been identified during initial investigations.

Twelve to 15 vessel deliveries per year are made from all origins to the Lorain Harbor petroleum dock and storage area. These deliveries occur primarily between the months of April and November and average about two or three trips per month. Therefore, due to the small annual volumes and the less than full utilization of the existing 27 feet LWD Federal project depths in the Black River, future receipts for this commodity were not forecasted during the 50-year project planning period.

Table B7 - Petroleum Fleet at Lorain Harbor, OH

Vessel Name	Length (ft.)	Beam (ft.)	Mid-Summer Draft (ft.)	Capacity at Mid-Summer (bbls.)
Gemini	430	65	23'0"	75,000
Jupiter	390	60	19'1"	55,000
Saturn	384	55	19'10"	48,000
Phoenix*	341	54	18'6"	57,000

*Tank barge; all other vessels shown are powered tankers.

Source: Greenwood's Guide to Great Lakes Shipping, 1979 Edition.

B2.4 Sand and Gravel

Annual receipts of sand, gravel, and crushed stone products at Lorain Harbor range from 350,000 to 450,000 tons. This material is used primarily for road building or construction aggregates. Total annual traffic fluctuates with the level of local construction and changes in the regional economy. Two individual dock operators (Erie Sand and Gravel Company and Griffith Blacktop, Inc.) account for the majority of total annual harbor receipts.

A summary of the sand, gravel, and crushed stone receipts are summarized in Table B8 below.

Table B8 - Historical Traffic of Sand, Gravel, and Crushed Rock
Lorain Harbor, OH

Year	Canadian Inbound	Local Inbound	Total Receipts
1973	69,300	340,800	410,100
1974	30,900	472,600	503,500
1975	29,000	373,000	402,000
1976	26,800	258,900	285,700
1977	28,300	457,700	486,000

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

Griffith Blacktop, Inc. operates one dock located near the lower turning basin downstream of the 21st Street Bridge on the east bank and leases a second dock near the upper turning basin on the east bank adjacent to the National Gypsum dock from the U. S. Steel Corporation. Sand shipments are delivered by small sand dredges (sandsuckers) which arrive almost daily during the navigation season. This material consists of lake sand dredged from established sand bars in Lake Erie. Crushed stone products have originated from Marblehead, OH, and have arrived via self-unloading vessels that have ranged in size up to 630 feet in length. Depths adjacent to their dock range from 21 to 22 feet LWD.

Erie Sand and Gravel Company operates a sand products dock on the west bank of the Black River downstream of the N&W Railroad Bridge. This company has storage for about 65,000 tons of material adjacent to their dock. Mobile equipment is used to transfer lake sand from stockpiles to dump trucks for local delivery to final consumers. The average tonnage handled at this dock for the last 5 years is about 250,000 tons. This tonnage originates primarily from sand bars in Lake Erie and is also transported via sand dredges.

Another company which also handles sand and stone products is Terminal Redi-Mix Company. Their dock is located on the east bank of the river upstream of the N&W Railroad Bridge. Sand is brought in by sand dredges, while stone originates from Marblehead, OH. Historically, this stone was shipped by self-unloading vessels, but in recent years this material has been brought in by truck from Sandusky, OH.

All three docks depend upon a fleet of vessels that are relatively old, small in size, and which do not make full use of the existing Federal project channel depths in the Black River. A summary of the vessels currently in service are shown in Table B9.

Future traffic levels for sand, gravel, and crush rock products are not projected due to the small vessel sizes that are presently in use and the low annual growth rate expected to occur for these products in the future.

Table B9 - Historical Fleet for Sand, Gravel and Stone Receipts
Lorain Harbor, OH

Vessel Name	Length (ft.)	Beam (ft.)	Mid-Summer Draft	Capacity at Mid-Summer (long tons)
John R. Emery	140	33	9'6"	490
Lakewood	390	48	19'5"	3,950
James B. Lyons	114	23	10'0"	900
F. M. Osborne	150	29	9'7"	500
Niagara	257	42	16'1"	1,860
J. S. St. John	174	32	13'3"	680
J. F. Schoellkopf, Jr.	557	56	21'8"	10,750 1/

1/ Vessel was scrapped at end of 1980 navigation season.

Source: Greenwood's Guide to Great Lakes Shipping, 1979 Edition.

B2.5 Limestone

Limestone receipts in recent years have accounted for 15 to 20 percent of total commercial activity at the harbor. A summary of historical limestone traffic at Lorain Harbor, OH, is included in Table B10. U. S. Steel Corporation operates a stone dock that is near the upstream limit of navigation on the west bank and consumes from 90 to 95 percent of all limestone unloaded at the harbor. This material is used as a fluxing agent during the production of pig iron at their Lorain-Cuyahoga Steel Works and is also a raw material input to their lime plant located adjacent to their blast furnace. Lime is eventually shipped by railroad or truck to final or intermediate end-users within the region while the steel products are shipped via truck and railroads to markets and industries located over an extensive geographic area.

Table B10 - Historical Limestone Receipts, Lorain Harbor, OH

Year	Foreign Inbound	Domestic Inbound	Total Limestone Receipts	Total Harbor Traffic	Percent of Total Harbor Traffic
1968	0	768,858	768,858	10,624,684	7
1969	0	729,719	729,719	9,112,820	8
1970	0	1,255,077	1,255,077	8,573,098	15
1971	0	1,235,734	1,235,734	7,483,789	16
1972	0	1,372,711	1,372,711	10,173,023	13
1973	0	1,738,988	1,738,988	11,584,368	15
1974	0	1,599,868	1,599,868	9,076,890	18
1975	0	1,379,981	1,379,981	7,650,341	18
1976	0	1,277,691	1,277,691	7,439,113	17
1977	0	1,235,005	1,235,005	6,286,913	20

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

The second largest user of limestone is Griffith Blacktop, Inc., which has a dock located opposite the steel plant on the east bank. Limestone receipts at their dock have been declining in recent years and have averaged about 82,000 tons per year during the period 1972 through 1977. Most of their annual receipts are carried in self-unloading vessels operated by U. S. Steel Corporation.

Two other docks (Toledo, Lorain, and Fairport Company and Terminal Redi-Mix, Inc.) have also occasionally handled limestone. Their average traffic volume has averaged only 3,500 tons/yr and 12,800 tons/yr, respectively. Terminal Redi-Mix, Inc. has indicated that waterborne shipments are no longer cost effective for them under present economic conditions, and this company now receives truck loads of limestone from Sandusky, OH. The Toledo, Lorain, and Fairport Company dock site has been recently acquired by Republic Steel Corporation and is now under conversion to a taconite transshipment terminal. No future waterborne deliveries of limestone are expected at either of these two docks in the future.

The flow of limestone traffic from ports in the upper lakes to Lorain, OH, is relatively stable. Two origin harbors (Port Dolomite, MI, and Calcite, MI) have consistently participated in the annual flow of limestone to Lorain, OH. Both of these origin harbors account for at least 95 percent of the limestone unloaded each year at the harbor. A summary of the limestone flows by origin are included in Table B11.

Table B11 - Historical Sources of Limestone - Lorain, OH

Origin	1977	1976	1975	1974	1973	1972
Port Dolomite, Michigan	321,791	338,779	376,764	465,643	468,942	386,792
Calcite, Michigan	861,911	874,064	960,115	1,132,990	1,224,852	935,003
Marblehead, Ohio	51,303	64,848	43,102	1,235	45,194	42,170
Kelleys Island, Ohio	0	0	0	0	0	8,746
Total Limestone Receipts 1/ (All Docks)	1,235,005	1,277,691	1,379,981	1,599,868	1,738,988	1,372,711

1/ Tonnage statistics represent limestone receipts at lakefront and upriver commercial docks.

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

Limestone traffic is presently moving in self-unloading bulk vessels to docks along the Black River. U. S. Steel Corporation dominates the traffic flows within the harbor in terms of annual limestone receipts. Therefore, the composition of the historical limestone fleet serving this harbor has been heavily influenced by the vessel types and sizes in the U. S. Steel Corporation's Great Lakes self-unloading fleet. An overview of the distribution of vessels and their sizes used at Lorain Harbor between 1972 and 1976 is shown in Table B12.

Table B12 - Historical Limestone Fleet Summary
Lorain Harbor, OH

Vessel Size	1976	1975	1974	1973	1972
Class IV (550 to 599 feet)	19%	19%	6%	28%	19%
Class V (600 to 649 feet)	43%	45%	56%	72%	79%
Class VI (650 to 699 feet)	26%	24%	32%	0%	0%
Class VII (700 to 730 feet)	12%	12%	5%	0%	0%
Total Domestic Traffic 1/	1,277,691	1,379,981	1,599,868	1,738,988	1,372,711

1/ Tonnage statistics represent vessel movements to all limestone docks.

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers

U. S. Steel Corporation operates its own Great Lakes fleet and is capable of moving most of its annual limestone requirements from Port Dolomite and Calcite, MI, to its upriver steel plant. A summary of the characteristics of their 1979 self-unloading fleet is shown in Table B13.

Table B13 - U. S. Steel Corporation Self-Unloading Vessel Fleet
Lorain Harbor, OH

Vessel Name	Year Built 1/	Approximate Dimensions (in feet)	Mid-Summer Capacity (long tons)	Class Designation 4	5	6	7	8	9	10
Irvin L. Clymer	1917/1954	552 X 60	12,100	X						
T. W. Robinson	1925	588 X 60	13,400	X						
Rogers City	1923/1955	552 X 60	12,500	X						
Calcite II	1929/1961/1964	605 X 60	13,000		X					
George A. Sloan	1943/1967	620 X 60	15,000		X					
Myron C. Taylor	1929/1956/1968	604 X 60	12,800		X					
John G. Munson	1952/1976	768 X 72	25,800					X		
Roger Blough	1972	858 X 105	44,500						X	
Edwin Gott	1979	1,004 X 105	74,100							X

1/ Date of initial construction may be followed by date of major rehabilitation, vessel conversion or vessel lengthening.

Source: Greenwood's Guide to Great Lakes Shipping, 1979 Edition.

Their self-unloading fleet is dominated by small older vessels of limited carrying capacity. The newer vessels acquired by U. S. Steel Corporation within the last decade are much larger and can carry larger volumes per trip at lower costs per ton. Although more than one-third of total limestone traffic from 1974 to 1976 was transported by Class 6 and Class 7 vessels, U. S. Steel Corporation does not own or operate any ships in these length categories. This company most likely contracts with other Great Lakes ship operators for delivery to their upriver stone dock. It is expected that no additional Class 7 vessels will be built and operated by U. S. Steel Corporation to service their Lorain limestone dock and that future limestone receipts will continue to move in their captive Class 5 vessels or be supplemented by other Great Lakes carriers utilizing Class 6 or Class 7 self-unloading vessel sizes.

B2.6 Iron Ore

Historical iron ore receipts at Lorain Harbor, OH, have originated from upper lakes ports (Duluth, MN; Two Harbors, MN; Superior, WI; and Taconite Harbor, MN) and Canadian harbors located along the Gulf of St. Lawrence (i.e., Port Cartier, Sept. Isles, and Pointe Noire). There are only two active iron ore docks within the Federal project limits. U. S. Steel Corporation operates an ore dock at the upper limit of navigation on the west bank of the Black River. A second dock at the lakefront that was previously owned by Chessie Railroad and operated by the Toledo, Lorain, and Fairport Company until 1978 has been recently purchased by Republic Steel Corporation. This site has undergone extensive structural modifications in the last 2 years in order to convert it to a modern transshipment facility for taconite pellets. These structural modifications to this dock will allow 1,000 X 105-foot self-unloading vessels to serve the lakefront Republic Steel dock.

In the past, upriver and lakefront docks were dependent on shore-side facilities for unloading the iron ore. This equipment consisted of shore-side Hulett cranes which remove the ore from the vessels to adjacent storage areas near the dock. Ore could then be transported via bridge cranes (i.e., ore bridges) or conveyors which could reclaim the ore from storage piles. The unloading cranes are usually situated in groups or batteries of three to five machines on each dock. Individual machine rates are approximately 600 to 750 tons per hour. Average dock rates for each group of Hulett unloaders are about 3,000 tons per hour.

Total harbor receipts of iron ore are summarized in Table B14. Most of the annual ore flow (about 75 percent) is handled at the upriver dock and consists almost exclusively of domestic receipts from Lake Superior harbors. The remainder of the domestic iron ore and all of the Canadian ore receipts have been unloaded at the lakefront. Canadian ore traffic, as a percent of total ore traffic, varies from year-to-year but does not represent a substantial percent of total iron ore receipts.

Table B14 - Historical Iron Ore Receipts
Lorain Harbor, OH

Year	Foreign: Overseas	Foreign: Canadian	Domestic	Subtotal Iron Ore	Total Harbor Traffic	Percent of Total
1968	0	167,142	3,858,997	4,026,139	10,624,684	38
1969	0	138,463	4,282,058	4,420,521	9,112,820	48
1970	0	214,029	3,207,041	3,421,070	8,573,098	40
1971	0	83,973	3,154,765	3,238,738	7,483,789	43
1972	0	125,794	4,088,498	4,214,292	10,173,023	41
1973	0	146,479	5,479,991	5,626,470	11,584,368	49
1974	0	72,044	4,637,571	4,709,615	9,076,890	52
1975	0	114,464	4,223,464	4,337,928	7,650,341	57
1976	0	427,313	4,130,128	4,557,441	7,439,113	61
1977	0	671,415	2,413,721	3,085,136	6,286,913	49

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

A distribution of iron ore receipts within the Federal project was derived by contacting individual dock operators and integrating their responses into the Waterborne Commerce Statistics data base. The dominance of iron ore receipts to upriver docks is shown in Table B15.

Table B15 - Distribution of Iron Ore Traffic Within Lorain Harbor, OH

Year	Lakefront	Percent of Total	Black River	Percent of Total	Total Iron Ore Receipts
1977	854,700	28	2,183,300	72	3,038,000
1976	1,127,900	26	3,239,900	74	4,367,800
1975	1,082,700	26	3,137,400	74	4,220,110
1974	874,200	19	3,711,000	81	4,585,200
1973	1,482,800	27	3,966,400	73	5,449,200

Source: Toledo, Lorain, and Fairport Company, U. S. Steel Corporation, and other local dock operators. Traffic estimates include domestic and Canadian receipts. Total harbor receipts may not agree with Waterborne Commerce Statistics in Table B14 due to variations in data collection method and units of measurement.

Labor disputes at iron ore mines in the upper lakes and strikes by maritime unions or lock operating personnel in the lower lakes have occasionally resulted in short-term distortions in the normal flow of raw materials to Lorain, OH. However, over the long term, the annual flow of iron ore from origin harbors in the GL/SLS system to Lorain Harbor is relatively stable.

There are six U. S. harbors on Lake Superior and one harbor on Lake Michigan that consistently ship ore to Lorain Harbor. An overview of their geographic locations is included in Figure B1. A tabular summary for the 6-year period 1972-1977, and the average iron ore movements from each origin to Lorain, OH, is also provided in Table B16. Historical patterns and sources of iron ore movements will be used in this report as the basis for developing the "most probable future" for future iron ore movements within the GL/GLS and within the harbor.

a. Lakefront Ore Dock Operation. Types of ore boats unloaded at the Outer Harbor dock prior to the start of the 1980 navigation season consisted primarily of bulk freighters which relied upon shore-side unloading cranes. The ore removed from the vessel could be either loaded directly to rail cars or trucks or deposited in an ore storage yard which had a capacity of about 1,000,000 tons. The lakefront dock operator at this time could also receive ore by self-unloading vessels at an alternate storage area on the west bank upstream of the Erie Avenue Bridge. This alternate site had an approximate capacity of 750,000 tons of material. Demolition and removal of the shore-side cranes was completed during the fall and winter of 1979 and substantial dock improvements have been made in order to receive iron ore by 1,000 X 105-foot vessels.

Outer harbor ore receipts during this period were predominately domestic (i.e., origins from U. S. ports on Lake Superior), although most of the

FIGURE B1

LOCATION OF IRON ORE SHIPPING PORTS
THAT SERVE LORAIN HARBOR, OHIO

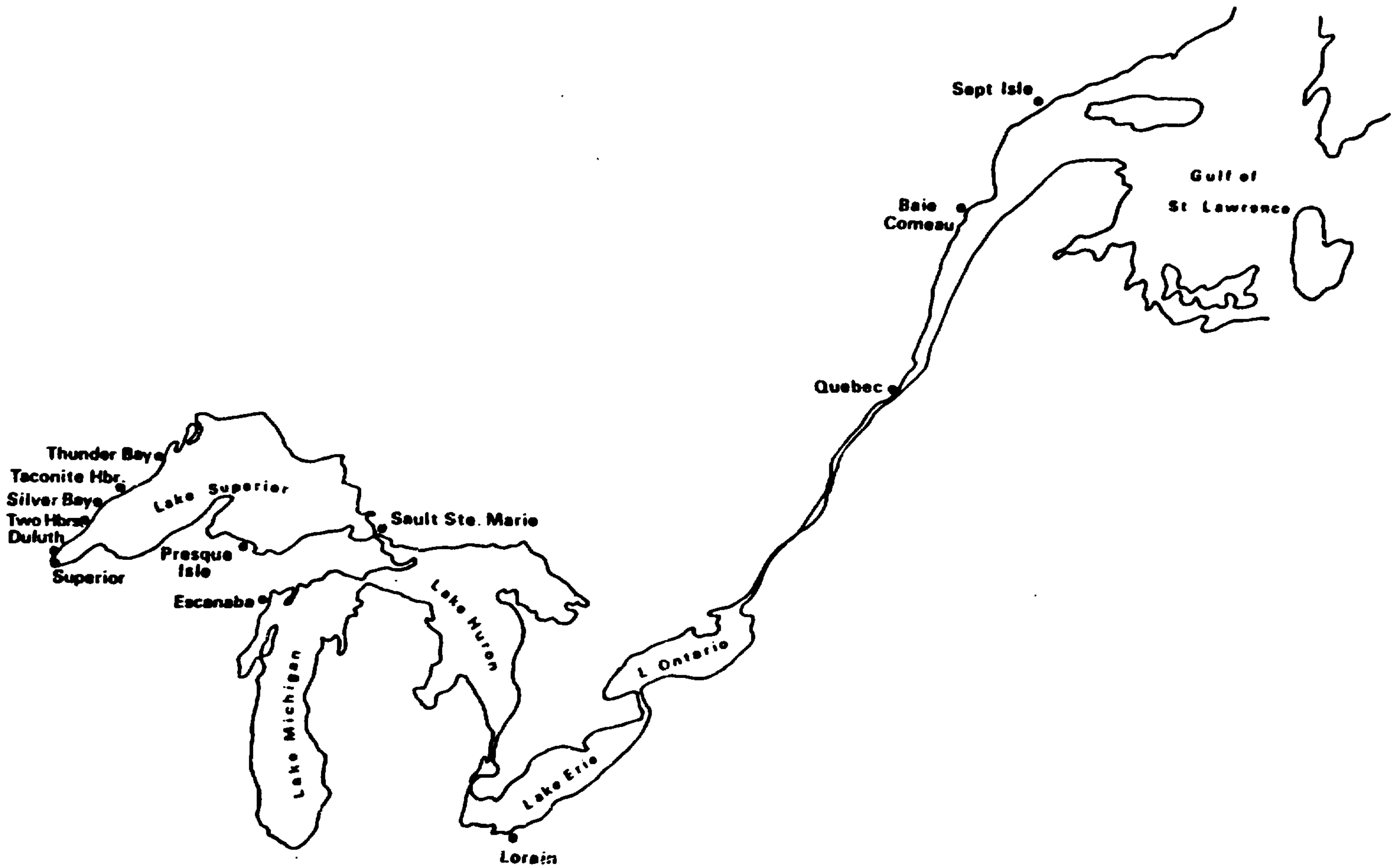


Table B16 - Historical Sources of Iron Ore
Lorain Harbor, OH

Origin	Period of Analysis						Average	Percent
	1977	1976	1975	1974	1973	1972		
Gulf of St. Lawrence and Vicinity	671,415	427,313	114,464	72,044	146,479	125,794	259,600	6
Escanaba, MI	264,741	328,589	167,206	85,167	91,572	38,595	162,600	4
Presque Isle, MI	62,218	181,792	179,037	48,576	132,923	101,895	117,700	2
Superior, WI	109,893	48,412	185,295	279,632	285,164	332,573	206,800	5
Duluth, MN	1,699,288	2,875,873	2,477,942	3,320,567	3,634,962	2,052,357	2,676,800	61
Taconite Harbor, MN	88,938	54,570	330,995	100,919	338,087	140,910	175,500	4
Two Harbors, MN	188,643	539,182	749,352	644,525	929,235	1,274,972	720,900	16
Silver Bay, MN	0	101,710	133,637	158,185	69,048	147,196	101,600	2
Total Harbor Receipts 1/	3,085,136	4,557,441	4,337,928	4,709,615	5,626,470	4,214,292	4,421,800	100

1/ Includes Canadian and domestic iron ore receipts at all docks.

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

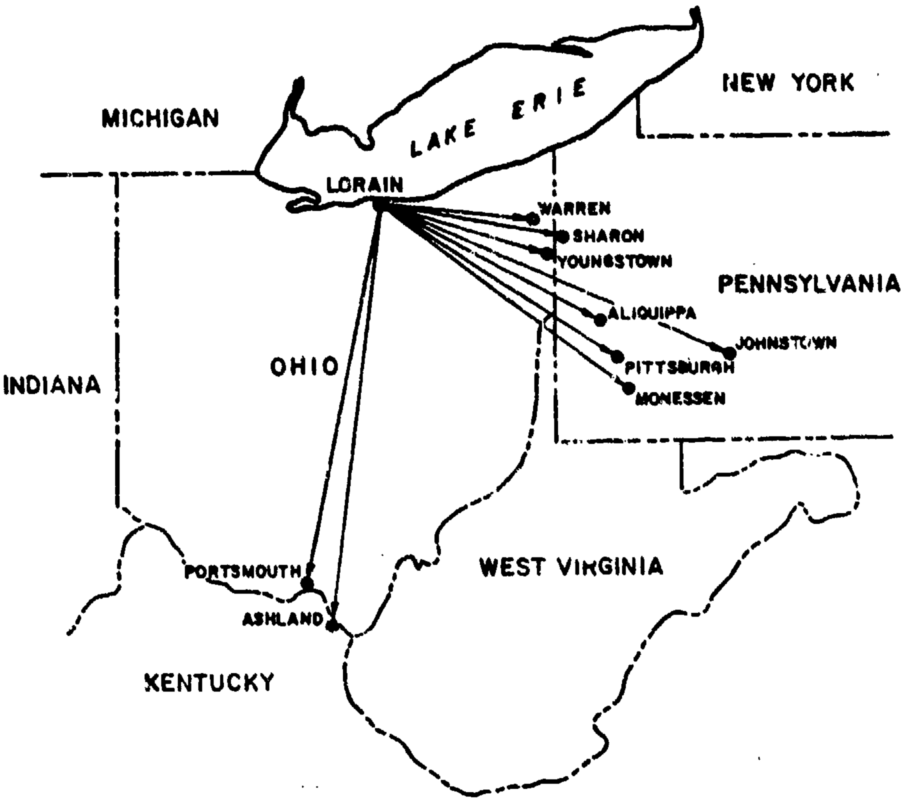
Canadian iron ore unloaded at the harbor was also handled at the lakefront dock. A mixture of iron ore from Canadian and domestic origins resulted from the variety of inland steel plants that utilized the lakefront transshipment dock. Several of these inland plants in Ohio and Pennsylvania have long-term contractual arrangements with iron ore mines and an equity interest in numerous U. S. and Canadian iron ore mines. A summary of the geographical location of the inland consumers of ore transshipped from the lakefront dock is shown in Figure B2. Annual tonnages transshipped via Lorain, OH, to inland steel plants varied from 1,480,000 to 850,000 tons during the period 1973-1977.

Canadian vessels which can serve the lakefront dock are constrained in size to a maximum of 730 X 75 feet due to the St. Lawrence River and Welland Canal lock sizes, while receipts from the upper lakes cannot exceed a maximum of 1,000 X 105 feet. A review of the Great Lakes fleet which has transported domestic (i.e., U. S. harbors to U. S. harbors) receipts of iron ore to the lakefront is shown in Table B17. Exclusion of Canadian vessels from this summary table will not distort the average historical fleet profile since Canadian receipts represent a small percent of total lakefront traffic.

b. Black River Ore Dock Operation. U. S. Steel Corporation operates a stone and ore dock on the west bank of the Black River at the upper limits of navigation. More than 75 percent of total ore unloaded in the harbor moves upstream to the U. S. Steel Corporation dock. Water depths alongside their docks range from 23 to 28 feet at Low Water Datum and there is about 2,490 feet of berthing space available for self-unloading and bulk vessels. Three electric Hullett-type ore unloaders on the wharf can unload about 1,500 tons per hour. Material unloaded can then be placed onto a conveyor system or moved by a bridge crane to a 3,000,000-ton storage area at the rear of the dock.

Almost all of their iron ore originates from Lake Superior harbors since this company also owns and operates several large iron ore mines in this region. The only substantial volume of Canadian ore received upriver was in 1977 as a result of a strike at the U. S. mines in the Lake Superior region. A summary of historical trends in raw material sourcing are presented in Table B18.

FIGURE B2



IRON ORE HINTERLAND
LORAIN HARBOR, OHIO
1973 - 1977

Table B17 - Historical Iron Ore Fleet Summary at Lakefront Dock
Lorain Harbor, OH

Vessel Size	1976	1975	1974	1973	1972
Class III (500 to 549 feet)	1%	0%	2%	1%	2%
Class IV (550 to 599 feet)	0%	0%	3%	1%	12%
Class V (600 to 649 feet)	93%	57%	72%	63%	45%
Class VI (650 to 699 feet)	6%	31%	9%	18%	9%
Class VII (700 to 730 feet)	0%	7%	5%	1%	15%
Class VIII (731 to 849 feet)	0%	6%	9%	16%	16%
Total Domestic Traffic (000's short tons)	933,111	1,102,601	881,145	1,540,536	799,495

Source: Waterborne Commerce of the United States, unpublished Statistics, 1972-1976.

Table B18 - Origins of Domestic Iron Ore Flows to Upriver Docks
Lorain Harbor, OH

Origin Harbor	1972	1973	1974	1975	1976	1977
Superior, Wisconsin	101,709	0	0	0	0	0
Two Harbors, Minnesota	1,274,972	912,900	644,525	730,863	539,182	188,643
Duluth, Minnesota	1,912,322	3,026,555	3,048,963	2,389,965	2,657,835	1,449,030
Total Domestic Receipts	3,289,003	3,939,455	3,693,488	3,120,863	3,197,017	1,637,673 1/

1/ Domestic receipts decreased substantially from preceding 5 years due to strike at upper lakes iron ore mines. Canadian receipts of iron ore increased temporarily in an attempt to mitigate raw material deficits.

Source: Waterborne Commerce of the United States, Corps of Engineers.

B3. SHIPBUILDING

B3.1 General

American Shipbuilding Corporation is located on the east bank of the Black River about 0.2 mile upstream from the Erie Avenue Bridge. This company is active in the construction, outfitting, conversion and repair of Great Lakes vessels. In addition to new ship construction, the Lorain yard also conducts the required 5-year vessel inspections required by the U. S. Coast Guard. The Lorain, OH, facility is one of three shipyards located in the Great Lakes operated by American Shipbuilding Corporation; other locations include Chicago, IL, and Toledo, OH. A summary of their physical characteristics are shown below.

Location	Length (ft)	Entrance Width (ft)	Maximum Overall (ft)
Lorain, OH			
Graving Dock No. 2	733	82	730
Graving Dock No. 3	1,025	125	1,027
Chicago, IL			
Graving Dock No. 1	Presently used as a wet slip.		
Graving Dock No. 2	708	88	733
Toledo, OH			
Graving Dock No. 1	545	80	540
Graving Dock No. 2	660	94	666

The shipyard at Lorain, OH, also has constructed three of the new 1,000 X 105-foot self-unloading "super-carriers." The JAMES R. BARKER was launched in the fall of 1976 while its sister ship, the MESABI MINER, was completed about 1 year later. A third vessel was constructed for U.S. Steel Corporation and was launched in 1980. Future construction of these large vessels should continue at the present level for several more years.

Demand for future transportation requirements and vessel replacements within the existing Great Lakes fleet are primary determinants of future vessel construction. A distribution of the existing Great Lakes fleet in terms of the number of vessels within each age group can be used to predict the expected vessel retirement schedule. This vessel-aging approach, in conjunction with other assumptions such as length of economic service life and bulk commodity forecasts, could estimate ship tonnage or annual carrying capacity lost due to vessel retirements from the Great Lakes fleet. Annual tonnage lost can be replaced by either construction of a few large vessels or more vessels of the same size.

Exact forecasts of new vessel construction cannot be predicted since the cost of capital, level of vessel construction subsidies, and demand for bulk material transportation services within the GL/SLS region can only be estimated. Future fleets required to move forecasted tonnages of iron ore, stone, coal, and grain were developed for the MAXIMUM SHIP SIZE STUDY (December 1977). An objective of this study was to establish the system

parameters for facility size, expected costs, and estimated benefits for total system or subsystem improvements. A summary of the future fleet required to move the long-term demand for bulk commodities is shown in Table B19.

New vessels required during the project planning period can be built at a number of Great Lakes shipyards. Major shipyards and dry docks and their maximum physical dimensions are summarized in Table B20. Geographic locations of active shipyards in the Great Lakes region are shown in Figure B3.

Several shipyards which might otherwise participate in the construction of 1,000 X 105 super-carriers may be constrained by their geographic location. Maximum size vessel construction is presently limited to shipyards on the upper four lakes since the Welland Canal and St. Lawrence River locks (i.e., 730 X 75 X 25.5 feet) prevent entry of this vessel size into the system.

Table B19 - Future Great Lakes Fleet 1980-2040 1/

Ship Size Allocation	Forecast Period 1980	1990	2000	2010	2020	2030	2040
Class V	74	40	24	18	17	12	12
Class VI	22	23	24	20	15	13	13
Class VII	53	46	38	31	26	27	27
Class VIII	12	25	39	43	43	44	43
Class IX	1	1	1	1	1	1	1
Class X	11	11	11	11	11	11	11
Subtotal for Historical Ship Sizes	173	146	137	124	113	108	107
Incremental Number of Maximum Ships to Carry Forecasted Tonnage							
1,100 X 105 X 25.5	0	15	24	29	37	40	44
1,200 X 130 X 25.5	0	14	19	24	29	33	35
Total Great Lakes Fleet 2/							
1,100 X 105 X 25.5	173	161	161	153	150	148	151
1,200 X 130 X 25.5	173	160	156	148	142	141	142

1/ Includes vessel requirements for iron ore, limestone, coal, and grain movements at a maximum draft of 25.5 LWD. Deeper drafts decrease required number of vessels in Great Lakes fleet.

2/ Total of historical ship sizes and either the sum of additional 1,100 X 105 or 1,200 X 130 maximum size design vessels.

Source: MAXIMUM SHIP SIZE STUDY, North Central Division, Corps of Engineers, December 1977.

Table B20 - Major Dry Docks in the GL/SLS System

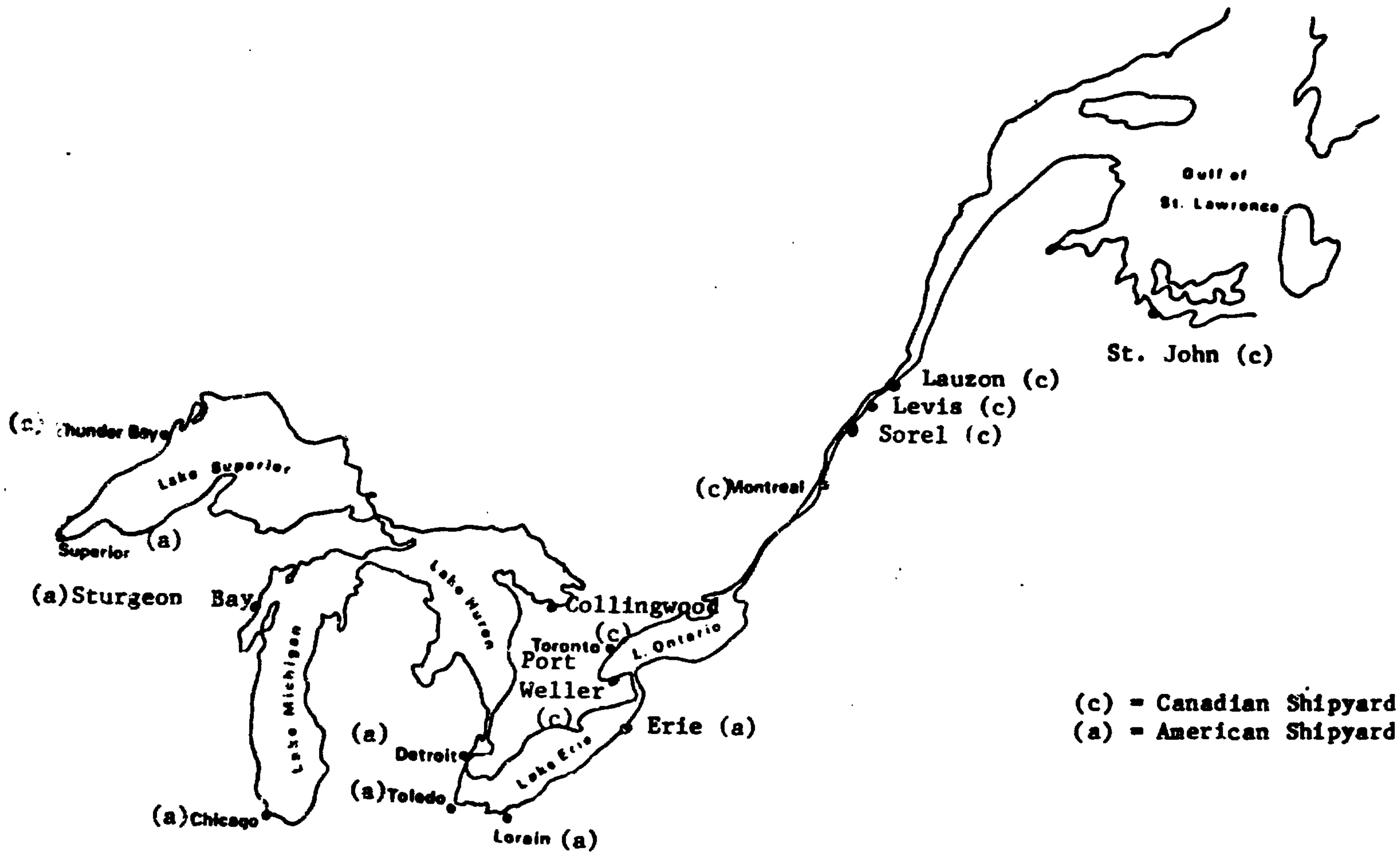
Location	Owner	Type	Maximum Dimensions Length	Maximum Dimensions Width	Remarks
Collingwood, ONT	Collingwood Shipyards	Graving	518	78	Maximum ship overall length 500 feet.
Detroit, MI	Nicholson Terminal and Dock Company	Floating	156	57	Maximum overall dimensions 200 X 50 feet.
Erie, PA	Litton Industries	Graving	1,250	130	Maximum overall ship length is 1,100 feet.
Lauzon, Levis, QUE	Dept. of Public Works				
	Champlain	Graving	1,150	120	Champlain Dock can be made into two docks; one 638 feet and one 484 feet.
	Lorne	Graving	600	62	
Lorain, OH	American Shipbuilding Company				
	Drydock Two	Graving	733	82	Maximum overall ship lengths for No. 2 dock is 730 feet and No. 3 dock is 1,027 feet.
	Drydock Three	Graving	1,025	125	
Montreal, QUE	Vickers Canada				
	Number One	Floating	600	100	Can be made into two docks; one 403 feet and one 197 feet long.
	Number Two	Floating	785	110	
Port Weller, ONT	Port Weller Dry Docks	Graving	750	80	Maximum ship overall dimensions are 730 X 76 feet
Saint John, NB	St. John Shipbuilding and Dry Dock Company				
	Number One	Graving	1,180	133	Dock No. 1 can be converted into two docks, 650 feet and 500 feet each.
	Number Two	Graving	444	84	
Sorel, QUE	Marine Industrie Limitee				
	Number One	Railway Dry Dock	420	-	1/
	Number Two	Railway Dry Dock	260	-	
South Chicago, IL	American Shipbuilding Company				
	Number One	Graving	(now in use as a wet ship)		
	Number Two	Graving	708	88	Maximum ship overall length is 733 feet.
Sturgeon Bay, WI	Bay Shipbuilding Corporation				1/
	Number One	Graving	225	45	
	Number Two	Floating	604	76	
	Number Three	Graving	1,158	140	
	Peterson Builders, Inc.				
	Number One	Floating	360	40	Maximum ship overall length is 350 feet.
Superior, WI	Fraser Shipyards, Inc.				
	Number One	Graving	628	66	Maximum ship overall length for No. 1 is 621 feet and 840 feet for No. 2.
	Number Two	Graving	831	85	
	Number Three	Floating	377	44	
Thunder Bay, ONT	Port Arthur Shipbuilding Company				
	Number One	Graving	750	80	Maximum ship overall dimensions are 747 X 48 feet.
Toledo, OH	American Shipbuilding Company				
	Number One	Graving	545	80	Maximum overall ship lengths for No. 1 is 540 feet and 666 feet for No. 2 dock.
	Number Two	Graving	660	94	

1/ No maximum vessel size limitation specified.

Source: Greenwood's Guide to Great Lakes Shipping, 1979 Edition.

LOCATION OF SHIPYARDS AND DRY DOCKS
IN GL/SLS SYSTEM

FIGURE B3



B4. HISTORICAL FLEETS - IRON ORE

Historical fleets used to ship iron ore which originates from U. S. harbors to Lorain, OH, are shown in Table B20A. This fleet summary excludes the Canadian iron ore receipts. However, since the historical Canadian ore has averaged about 215,000 tons per year during the interval 1968 through 1977, this is only about 5 percent of the total ore receipts and should not significantly distort average fleet characteristics.

Table B20A - Historical Iron Ore Fleets 2/
Lorain Harbor, OH

Vessel Size	Period of Analysis				
	1976	1975	1974	1973	1972
Class III (500 to 549 feet)	1%	0%	0.5%	1/	1%
Class IV (550 to 599 feet)	0%	0%	0.5%	1/	2%
Class V (600 to 649 feet)	97%	87%	94%	86%	88%
Class VI (650 to 699 feet)	2%	10%	2%	5%	2%
Class VII (700 to 730 feet)	0%	2%	1%	1/	3%
Class VIII (731 to 849 feet)	0%	1%	2%	8%	4%
Total Domestic Traffic	4,130,128	4,223,464	4,637,571	5,479,991	4,088,498

1/ Less than 0.5 percent.
2/ Average for all docks receiving iron ore.

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

B4.1 Iron Ore Fleet - Upriver

The U. S. Steel Corporation Great Lakes fleet consists primarily of Class V bulk freighters that have an average age of 50 years and an average midsummer carrying capacity of about 14,900 tons. Most of the iron ore loaded at U. S. Lake Superior ports must transit the Soo Locks on its way to Lorain, OH. A summary of the 1979 Great Lakes U. S. Steel fleet is shown in Table B21. This fleet size has significantly affected the historical fleet profile used to transport iron ore upriver and is presented in Table B22.

Table B21 - U. S. Steel Corporation Great Lakes Fleet
Bulk Freighters Operating in 1979

Vessel Name	Approximate Dimensions	Year Built 1/	Mid-Summer Capacity 2/	Class Designation 5	6	7	8 3/
B. F. Affleck	604 X 60	1927	13,950	X			
Sewell Avery	620 X 60	1943	16,700	X			
Eugene F. Buffington 4/	601 X 58	1909	12,450	X			
D. M. Clemson 4/	600 X 60	1917	14,100	X			
Thomas F. Cole 4/	605 X 58	1907	12,550	X			
Alva C. Dinkey 4/	601 X 58	1909	12,450	X			
Benjamin F. Fairless	639 X 67	1942	19,150	X			
A. H. Ferbert	639 X 67	1942	19,150	X			
Leon Fraser	639 X 67	1942	19,150	X			
Joshua A. Hatfield	600 X 60	1923	13,875	X			
John Hulst	611 X 60	1938	14,150	X			
William A. Irvin	610 X 60	1938	14,050	X			
Horace Johnson	604 X 60	1929	13,700	X			
D. G. Kerr 4/	610 X 60	1916	14,100	X			
Thomas W. Lamont	604 X 60	1930	14,100	X			
Governor Miller 4/	610 X 60	1938	14,050	X			
J. P. Morgan, Jr. 4/	601 X 58	1910	12,240	X			
Irving S. Olds	639 X 67	1942	19,150	X			
Eugene W. Pargny	620 X 60	1917/ 1951	14,100	X			
Robert C. Stanley	620 X 60	1943	16,550	X			
Eugene P. Thomas	603 X 60	1963	14,100	X			
Enders M. Voorhees	639 X 67	1942	19,150	X			
Ralph H. Watson	611 X 60	1938	14,150	X			
Peter A. B. Widener 5/	601 X 58	1906	12,800	X			
Homer D. Williams	600 X 60	1917/ 1951	14,200	X			
August Ziesing	600 X 60	1918	13,300	X			
Arthur M. Anderson	767 X 70	1952/ 1957	26,525				X
Cason J. Callaway	767 X	1952/ 1974	26,525				X
Philip R. Clarke	767 X 70	1952/ 1974	26,525				X

1/ Most recent year indicates date of vessel lengthening or major power unit modification.
2/ Capacity is stated in long tons of 2,240 pounds.
3/ Largest size vessel which can safely and efficiently navigate the Black River is a Class 7.
4/ Scrapped after end of 1980 navigation season.
5/ Converted to a grain storage barge.

Source: Greenwood's Guide to Great Lakes Shipping, 1979 Edition.

Although Class VI and Class VIII vessels have transported iron ore upriver, these particular vessel sizes are not included within the U. S. Steel 1979 Great Lakes fleet.

Table B22 - Historical Fleet Summary for Upriver Iron Ore
Lorain Harbor, OH

Vessel Size	1976	1975	1974	1973	1972
Class V (600 to 649 feet)	98%	97%	100%	95%	99%
Class VI (650 to 699 feet)	2%	3%	0%	0%	0%
Class VII (700 to 730 feet)	0%	0%	0%	0%	0%
Class VIII (731 to 849 feet)	0%	0%	0%	5%	1%

Source: Waterborne Commerce of the United States, Corps of Engineers.

B4.2 Iron Ore Fleet - Lakefront

Historical fleet characteristics at the lakefront dock consist of larger vessels with greater carrying capacity operated by a variety of shipping companies. Numerous inland steel plants tranship via the lakefront dock at Lorain Harbor, and many of them have long-term direct and indirect arrangements to purchase ore, use specific vessels or transship over certain docks operated by other steel companies or their subsidiaries. This results in a more diversified fleet servicing the lakefront dock relative to the fleet which is captive to the U. S. Steel Corporation.

A summary of the fleet distribution by vessel class at the lakefront dock is shown in Table B23.

However, recent changes in the ownership of the lakefront ore dock prevents the use of historical fleet trends to be used as the basis for projecting future iron ore fleets at the lakefront. Iron ore receipts at the new Republic Steel Corporation transshipment terminal are expected to be dominated by Class X vessels after 1980. Federal improvements in the Outer Harbor at Lorain, OH, are considered by Republic Steel Corporation to be capable of allowing 1,000 X 105-foot maximum size vessels to safely navigate to their lakefront ore dock. This plan of operation would significantly alter the historical maximum base case vessel size of a Class VIII vessel which was identified as entering the Outer Harbor in 1972 and 1973.

Class X vessels are now scheduled to arrive in Spring 1980. Iron ore tonnage will be railed inland to Republic's steel plants in the Warren-Youngstown, OH, area. Later in the 1980 navigation season, ore will be reloaded into smaller vessels (about 630 X 68 feet) for a waterborne shuttle to Republic's

steel plants located at the upstream limit of navigation on the Cuyahoga River in Cleveland, OH. Detailed engineering and operational data on this transshipment terminal has been published in Skillings Mining Review, 1 December 1979, a copy of which is also included in Appendix E.

Table B23 - Historical Fleets at Lakefront Ore Dock
Lorain Harbor, OH

Vessel Size	Period of Analysis 1976	1975	1974	1973	1972
Class III (500 to 549 feet)	1%	0%	2%	1%	2%
Class IV (550 to 599 feet)	0%	0%	3%	1%	12%
Class V (600 to 649 feet)	93%	57%	72%	63%	45%
Class VI (650 to 699 feet)	6%	31%	9%	18%	9%
Class VII (700 to 730 feet)	0%	7%	5%	1%	15%
Class VIII (731 to 849 feet)	0%	6%	9%	16%	16%
Total Domestic Traffic	933,111	1,102,601	881,145	1,540,536	799,495

Source: Waterborne Commerce of the United States, Part 3, Great Lakes, Corps of Engineers.

In conclusion, a range of vessels have been used to transport iron ore to Lorain Harbor. A review of the fleet in service between 1972 and 1976 has identified vessels which ranged from Class 3 (i.e., 500 to 549 feet in length) up to a Class 8 (i.e., 731 to 849 feet in length). Vessel movements to both the lakefront and upriver docks are dominated by Class 5 vessels which accounted for 97 percent of all domestic ore receipts at the harbor.

B5. BENEFITS

B5.1 Introduction

The last major harbor modification at Lorain Harbor, OH, was completed in the early 1960's as a result of the Great Lakes Connecting Channels Study (published as Senate Document No. 71, 84th Congress) which concluded that this harbor would benefit from deeper and wider channels. Maximum size vessels at that time were Seaway size vessels (i.e., 730 X 75 X 25.5). Engineering modifications were subsequently constructed in the Outer Harbor and in the Black River to allow Seaway vessels to navigate safely to the upper limit of the Federal project.

Plans of improvement have been identified within the Reconnaissance Report - (Revised January 1979) and formulated in this Stage II document to allow 1,000 X 105-foot vessels to operate under "safe and efficient" conditions into the Outer Harbor and up the Black River. This planning investigation follows a traditional approach for harbor modifications in that plans of improvement have been formulated to allow present-day maximum ship sizes to navigate safely and efficiently throughout the limits of the existing Federal project. However, a point of diminishing returns may soon be approached within the GL/SLS system since the physical requirements of these new super-carriers may require major modifications (straightening and relocations) that are expensive, environmentally and socially disruptive to the local industrial base and related land uses which have evolved since the last major harbor project many years ago.

Transportation concepts which represented the least cost method of materials handling a decade ago may now be inadequate. For example, direct delivery to upriver ore docks has traditionally been economically justified as larger vessels were built for the Great Lakes fleet. However, recent planning investigations into harbor improvements to handle bulk commodity movements at Cleveland Harbor, OH, indicated that extensive Inner Harbor modifications for maximum size vessels were not cost effective and that transshipment from the lakefront was more economical.

All plans of improvement at Lorain, OH, include elements of both Federal and non-Federal costs. Federal costs are traditionally associated with breakwaters, entrance and primary access channels, turning basins and anchorage areas, and highway and railroad bridge alterations. Non-Federal interests are responsible for and bear the costs of terminal and transshipment facilities, dredging of interior access channels, acquisition of lands, easements, rights-of-way, and utility relocations. Utilization of larger vessels at the harbor will result in non-Federal interests incurring a greater share of the total costs for future navigation improvements within the GL/SLS as transshipment options become more cost effective.

Three transportation concepts will be evaluated: direct delivery, partial transshipment from a point downstream of the 21st Street Bridge, and transshipment from the lakefront.

The Reconnaissance Report for Lorain Harbor, OH (Revised January 1979) identified a number of alternatives for further study. Preliminary designs and costs for these suggested improvements were developed in November 1979. The portion of total costs to be paid by the Federal Government and/or local interests vary a great deal while the expected annual benefits for all plans of improvement are approximately the same. It is expected that the plan of improvement with the lowest first cost will eventually be identified as the Selected Plan. The following section includes an evaluation of the proposed plans of improvement and measurement of economic benefits and costs of each transportation concept and the detailed justification of incremental Federal participation of the Selected Plan.

B5.2 Benefits Methodology

Local interests have requested the Corps of Engineers to investigate the economic feasibility of harbor improvements to allow larger vessels to operate on the Black River. Economic feasibility is affected by the interaction of future traffic flows, future fleet characteristics, and the cost of the engineering improvement. Fleets expected to move the tonnage have been estimated and costs per ton for a range of vessel classes are calculated. Changes in future transportation costs are developed and converted to an annual equivalent value and compared with total annual costs for each plan of improvement to derive net annual benefits.

Each receiving dock in the harbor was contacted to obtain information about their future traffic and future fleets. Republic Steel Corporation has stated that no major Outer Harbor modifications are necessary at this time for their lakefront dock to be fully operational. Their position is based upon current water levels of Lake Erie and the connecting channels and the operating experience of the transportation company that is under a long-term contract to carry their iron ore. However, U. S. Steel Corporation has stated that they would not operate current maximum size vessels into the Outer Harbor or up the Black River without major modifications to the existing Federal project. Therefore, separate commodity forecasts and base case vessel sizes have been developed for each iron ore dock.

Economic evaluations of various plans of improvement are based upon an analysis of Great Lakes vessel sizes. A system for identifying unique economic and operational characteristics for each class of vessel is a prerequisite for an evaluation of potential transportation savings. Physical and operating characteristics of each type of vessel within the Great Lakes fleet have been included in the economic evaluation. These statistics are used in conjunction with round trip distances, average speeds, and estimated loading and unloading times on individual origin/destination/commodity harbor pairings to construct transportation costs per ton for each vessel class expected to operate under existing and improved conditions.

Feasibility of proposed Federal harbor improvements is determined by measuring the potential transportation cost savings that exist between individual vessel classes and the extent and timing of larger vessels expected to operate after a plan of improvement is constructed. An immediate fleet

response will generally result in a greater level of transportation savings than a delayed or deferred private sector response.

Fleet forecasts for Lorain Harbor assume that sufficient shipbuilding capacity is available in the Great Lakes to support the implied demand for new vessel construction and that U. S. Steel Corporation and Republic Steel are not constrained in the number or size of ships necessary to move the forecasted iron ore tonnage. Therefore, construction of new shipyards will not be necessary to support the future fleet forecasts at Lorain Harbor. Forecasts of future fleets are based upon the assumption that the private sector will respond positively to any Federal plan of improvement by constructing, leasing or operating larger vessels.

The largest vessels presently operating on the Great Lakes are 1,000 X 105-foot self-unloading bulk vessels. These vessels are now used to carry western coal or iron ore pellets through the Poe Lock from upper lakes harbors to lower lakes ports. These maximum size vessels are presently dedicated to high volume origin-destination routes and do not carry any cargo on their return trip into the upper lakes. This one-way traffic is expected to continue during the project evaluation period.

Several more super-carriers are now under construction at U. S. shipyards at Lorain, OH, and Sturgeon Bay, WI, and the trend to maximum ship sizes is expected to continue throughout the project evaluation period. A summary of the vessel characteristics and owner-operators of 1,000-foot vessels presently under construction is included in Table B24.

Maximum size vessels operating on Lake Erie carry iron ore to several Federal harbors on the south shore of Lake Erie. A summary of U. S. harbors that have been serviced by maximum ship sizes in the past few years are shown in Table B25.

The feasibility of harbor improvements at Lorain, OH, have been based upon anticipated iron ore flows. Although there have been several feasibility studies that have investigated the potential of transshipping western coal via Lake Erie harbors, this preliminary economic evaluation of Black River improvements is based solely upon future iron ore flows. Other bulk commodities which have the potential for utilizing 1,000-foot vessels at the harbor will be considered in further detail in the Final Feasibility Report.

a. Upriver Iron Ore. The average traffic level at this dock during the period 1973-1977 was about 3,250,000 net tons and consisted of the raw materials required by the U. S. Steel plant. All of this ore is consumed locally although there have been minor tonnages transshipped to the U. S. Steel plant at Youngstown, OH, in the past. However, closure of this inland facility in 1980 has eliminated any potential for transshipment activity in the future. Future iron ore traffic on the Black River has been based upon a review of historical receipts, interviews with local U. S. Steel Corporation representatives, and a review of secondary sources of published traffic forecasts for iron ore within the GL/SLS region.

A recent downturn in the economic health of the domestic steel industry has probably deferred any major capital expenditures programs for U. S. Steel

Table B24 - Summary of Maximum Size Vessels in 1979 Great Lakes Fleet

Vessel Name	Vessel Operator	Overall Dimensions and Capacity				
		Length	Beam	Depth	Draft 1/	Capacity 2/
James R. Barker	Pickands, Mather, and Company	1,004	105	50	28'0"	59,700
Belle River	American Steamship Company	1,000	105	56	34'0"	78,850
Stewart J. Cort	Bethlehem Steel Corporation	1,000	105	49	27'10"	58,000
Lewis W. Foy	Bethlehem Steel Corporation	1,000	105	56	34'0"	78,850
Edwin H. Gott	U. S. Steel Corporation	1,000	105	56	32'1"	74,100
Mesabi Miner	Pickands, Mather and Company	1,004	105	50	28'0"	59,700
Presque Isle	Littor. Great Lakes Corporation	1,000	104'7	46'6"	28'7"	57,500
George A. Stinson	National Steel Corporation	1,004	105	50	28'0"	59,700

1/ Mid-summer draft in feet and inches.
2/ Capacity in gross tons of 2,240 pounds.

Source: Greenwood's Guide to Great Lakes Shipping - 1979 Edition.

Table B25 - Overview of Origins and Destinations of Maximum Size Vessels

Vessel Name	Origin	Destination	Iron Ore Tonnage	Trips
Stewart J. Cort (Bethlehem Steel)	Taconite Harbor, MN	Burns Harbor, IN	2,426,230	39
Presque Isle (Litton Great Lakes)	Two Harbors, MN	Gary, IN	1,721,920	25
	Two Harbors, MN	Calumet Harbor, IN	178,080	3
	Two Harbors, MN	Conneaut Harbor, OH	173,250	3
James R. Barker (Pickands, Mather and Company)	Taconite Harbor, MN	Indiana Harbor, IN	1,248,490	20
	Taconite Harbor, MN	Ashtabula Harbor, OH	108,850	2
Total			5,856,820	92

Source: Waterborne Commerce of the United States, Corps of Engineers, 1976.

Corporation in the short run. Local sources of information have indicated, in a general manner, that dock expansion plans are under consideration by the parent corporation to accommodate 1,000 X 105 vessels on the Black River. Adequate holdings of adjacent vacant real estate near their existing docks are now controlled by this company and would be available if a decision to expand is made in the future.

No detailed plans of improvement for their dock have been provided to the Buffalo District, Corps of Engineers, and a number of traffic forecasts provided by U. S. Steel Corporation became the basis for constructing a scenario of positive growth for iron ore receipts at their dock. A summary of this information is shown in Table B26.

All local sources of information were compared with the regional growth rate derived for the Great Lakes region as developed in the Great Lakes Traffic Forecast Study. This study investigated the long-term increase in iron ore flows and concluded that an annual growth rate of 1.7 percent per year was representative of the long run annual growth rate of the iron and steel industry within the GL/SLS. This estimate may be generally correct at the regional level but could over or understate potential iron ore movements for any individual firm within the industry.

All of the forecasts indicate a positive growth curve for ore traffic at Lorain Harbor. Preliminary design and cost estimates for a conveyor between the lakefront and the U. S. Steel dock utilized an economic life of 50 years and a design capacity of 8,000,000 million tons per year. This upper limit for future commodity flows was subsequently coordinated with the local steel plant and was found to be acceptable. This upper limit is also in general agreement with all previous local traffic forecasts summarized in Table B26.

The regional growth scenario (1.7 percent annual increase) was subsequently chosen as the basis for the economic evaluation of upriver improvements. Intermediate forecast values within this time series generally agree with local forecasts provided by U. S. Steel. Also, longer term traffic flows can provide the framework necessary for structuring the economic analysis during the remainder of the project period. Forecast values can be further refined, if necessary, in the Final Feasibility Report as additional information is developed.

b. Upriver Fleets. Derivation of transportation costs per ton by vessel class and the cost differentials that may exist between various sizes of vessels are the basis of the economic evaluation of considered harbor improvements. A classification system is required to group vessels with similar investment or operating characteristics. Historically, a distribution of the Great Lakes fleet has been based upon vessel length. This procedure is required to evaluate potential savings between existing and future fleets which will operate within the Federal project. A summary of the fleet classification system used for this study is shown in Table B27.

Table B26 - Summary of Upriver Iron Ore Receipts

Source	Base Period Average 1/	Forecast Period					
Forecast A 2/	3,250,000	No traffic estimates provided although U. S. Steel was considered to remain as "a major user for many years to come."					
Forecast B 3/	3,250,000	(1982) 4,108,000	(1985) 5,404,000				
Forecast C 4/	3,250,000		(1985) 3,500,000	(1995) 5,000,000	(2000) 7,000,000		
Forecast D 5/	3,250,000	No traffic estimates provided although an indication of maximum tonnage throughput after construction of a proposed expansion of upriver docks would be increased by 2,000,000 tons to a maximum annual volume of 4,000,000 tons for a single shift operation.					
Forecast E 6/	3,250,000	Interview by A/E firm preparing preliminary designs and costs concluded that a conveyor with an 8,000,000 ton design capacity would be acceptable to U. S. Steel Corporation.					
Forecast F 7/	3,250,000	(1990) 3,846,000	(2000) 4,553,000	(2010) 5,389,000	(2020) 6,378,000	(2030) 7,549,000	(2040) 8,935,000
Forecast G 8/	3,250,000	3,846,000	4,553,000	5,389,000	6,378,000	7,549,000	8,000,000

1/ Average receipts for the period 1973-1977, U. S. Steel Corporation letter dated 15 May 1978. May vary slightly from Waterborne Commerce statistics due to rounding errors and reporting inaccuracies.

2/ David G. VanBrunt, Marine Superintendent, U. S. Steel Corporation letter dated 15 May 1978.

3/ D. H. Pass, General Superintendent, Lorain-Cuyahoga Works, U. S. Steel Corporation letter dated 15 May 1978.

4/ Forecasts provided as an information handout by U. S. Steel Corporation during a 31 January 1979 workshop on future physical modifications to existing Federal project at Lorain Harbor, OH.

5/ Karl E. Kummant, Plant Engineer, Lorain-Cuyahoga Works, U. S. Steel Corporation letter dated 22 March 1979.

6/ Meeting in Lorain, OH, between K. Kummant and representatives of Michael Baker, Jr., Inc., on 31 March 1979. Objective of this discussion was to coordinate design modifications to upriver ore docks.

7/ Great Lakes Traffic Forecast Study, North Central Division, Corps of Engineers, 1976.

8/ Ibid., Forecast Values same as F except that 2040 tonnage is constrained by maximum design capacity of the conveyor alternative.

Table B27 - Classification of Vessels by Length (In Feet)

Class 1	Class 2	Class 3	Class 4	Class 5
Under 400	400 - 499	500 - 549	550 - 599	600 - 649

Class 6	Class 7	Class 8	Class 9	Class 10
650 - 699	700 - 730	731 - 849	850 - 949	950 - 1,099

Source: Appendix E - Commercial Navigation, Regulation of Great Lakes Water Levels, December 1973.

A large number of discrete pieces of information are used to arrive at a quantification of tangible transportation savings for the major bulk commodity groups. Most of this information was obtained from the Maritime Administration, U. S. Department of Commerce, and the Corps of Engineers. Physical and financial operating statistics for existing and future vessel sizes are displayed in Tables B28 and Table B29.

All of this information is used in conjunction with assumptions for minimum rates of return, economic and engineering life-cycle costs and expected length of the navigation season. Construction costs by vessel size and daily operating charges are used as a general guideline and will not be representative of any individual Great Lakes fleet operator. Total annual fixed and variable charges for each vessel class are assumed to be recovered by charging a specified freight rate per ton. Rate differentials that result from the use of a range of vessel sizes on a particular trade route can be calculated and used as a quantitative estimate of benefits for proposed Federal channel modifications and harbor improvements.

The flow of information among each step in the analysis is shown in schematic form in Figure B4. An iterative process is required to evaluate the differentials in the required freight rates for a range of vessel sizes.

The upriver steel plant relies primarily upon Class 5 ore boats that are unloaded by shore-based Hulett-type equipment. Larger size vessels (primarily Class 6 self-unloading vessels operated by American Steamship Company) have also moved iron ore to the upriver docks in recent years. Although these larger vessels represented only 2 to 3 percent of total annual ore receipts in 1976 and 1975, it demonstrates that vessels larger than Class 5 can operate on the Black River without additional harbor and channel improvements. Limestone is also transported in Class 7 self-unloading vessels to a stone dock adjacent to the upriver ore docks. However, there are no Class 6 and Class 7 self-unloading vessels in the 1979 U. S. Steel Great Lakes fleet.

Economic benefits are defined as the reduction in transportation costs per ton based upon the use of larger vessels relative to the existing base case vessel. The designation of a particular vessel class as the existing maximum size base case was based upon a review of existing vessels now in use by U. S. Steel Corporation or shipping companies that may be under contract to deliver their raw materials. Crediting all the potential transportation rate savings between the smallest ship size now in use and the maximum size design vessel would conceptually overstate net transportation savings and theoretically reward dock operators and shipping companies for operation of suboptimum ship sizes. The economic evaluation is, therefore, based upon potential transportation cost savings associated with the movement of projected volumes of iron ore between Class 7 vessels (maximum base case) and future maximum design vessels (i.e., 1,000 X 105).

c. Lakefront Iron Ore. Iron ore now moves into the Outer Harbor to the new ore transshipment dock operated by Republic Steel Corporation. This dock will handle ore destined for their Cleveland, OH, and Mahoning Valley steel plants. The tonnage to be consumed at the Cleveland plant will be

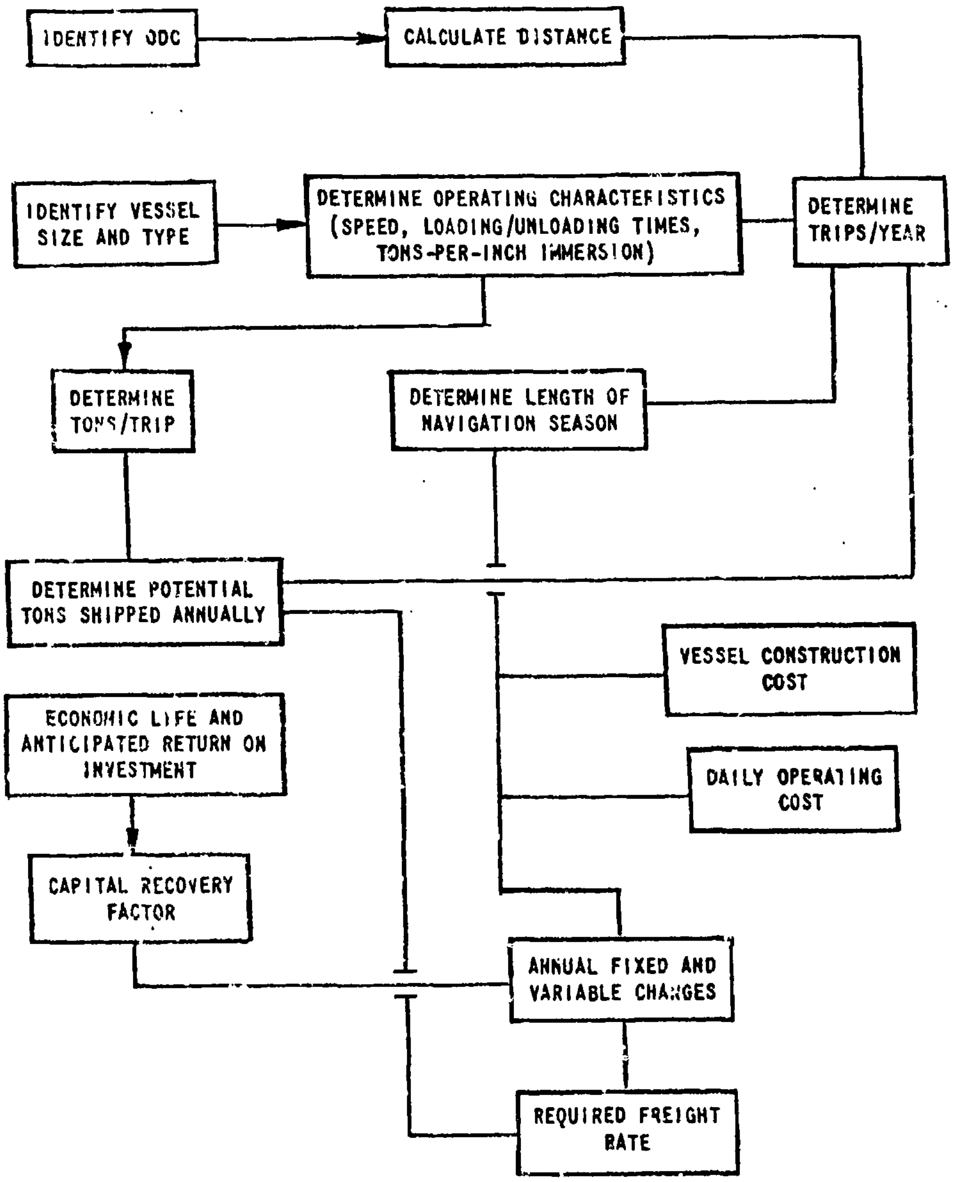


FIGURE B4 DERIVATION OF TRANSPORTATION COSTS PER TON FOR AN INDIVIDUAL ORIGIN-DESTINATION-COMMODITY (ODC) FLOW

Table B28 - Physical Characteristics of the Great Lakes Fleet

Vessel Class	Overall Length	Mid-Summer Draft (Feet)	Mid-Summer Capacity (Net Tons)	Capacity Per Inch of Draft (Net Tons)
V	600 to 649	26' 0"	22,000	106
VI	650 to 699	26'11"	26,000	123
VI (w)	650 to 699	30' 7"	37,900	169
VII	700 to 730	29' 1"	30,350	135
VII (w)	700 to 730	30' 7"	39,400	171
VIII	731 to 849	27' 0"	29,700	134
VIII (w)	731 to 849	30' 0"	49,300	198
IX	850 to 949	27'11"	49,840	202
X	950 to 1,000	28' 9"	69,000	244

SOURCE: Maximum Ship Size Study, December 1977, North Central Division, Corps of Engineers

Table B29 - Summary of Financial Operating Statistics

	Vessel Class					
	5	6	7	8	9	10
Deadweight Tonnage 1/	20,150	23,200	26,850	32,000	44,500	59,000
Approximate Length	625	700	730	806	858	1,000
Mid-Summer Draft	25'7"	26'4"	27'4"	28'6"	27'10"	27'10"
Construction Cost (Millions) 2/	$27M	$30M	$34M	$38M	$48M	$59M
Daily Vessel Operating Expenses	$14,279	$15,377	$15,907	$13,471	$20,729	$21,519

1/ Long tons of 2,240 pounds.
2/ June 1980 estimated prices.

Source: Maritime Administration, U. S. Department of Commerce, 1979.

reloaded into smaller self-unloading vessels capable of navigating upstream to their steel plant located adjacent to the Cuyahoga River. Ore destined to the Republic blast furnaces in the Warren-Youngstown, OH, area will be reloaded onto unit trains for the overland haul to inland plants. Republic has publicly stated that their contract with Interlake Steamship Company provides for the shipment of up to 6,500,000 tons of iron ore per year from upper lakes ports to Lorain, OH, using maximum size design vessels supplemented by smaller self-unloading vessels if necessary. This haulage contract will be fully implemented by 1981. Preliminary estimates of iron ore to be transshipped to Cleveland, OH, from their new outer harbor dock were estimated at 3,500,000 tons each year. The balance of 3,000,000 tons will be railed inland to the Warren-Youngstown, OH, area. Forecasted short-term commodity flows will be fully attained in late 1980 or early 1981 as start-up problems are resolved at the Outer Harbor transfer terminal dock. This tonnage flow will consist primarily of iron ore tonnage previously handled at Cleveland Harbor, OH, and other Lake Erie harbors.

Although additional traffic for the account of other steel companies may also be accommodated in the future, it was not included in this economic evaluation. Other users of the lakefront ore dock may develop in the future, but no specific companies have been identified at this time. If additional users are designated, their incremental tonnages will be incorporated into the benefits analysis.

d. Lakefront Fleets. The benefits evaluation for Outer Harbor improvements is based upon the movement of 6,500,000 tons per year throughout the 50-year project evaluation period. No growth in iron ore receipts at the lakefront dock has been credited to any plan of improvement. Information about physical expansion or modernization plans of Republic Steel in relationship to operation of their new taconite transshipment terminal was not available at the time of preparation of the Preliminary Feasibility Report.

Vessels used to transport this tonnage will be provided by the Interlake Steamship Company but actual vessels in service will vary from year-to-year. Trade publications have identified several of the vessels expected to operate on this trade route. A summary of these vessels is included in Table B30. It is unlikely that all future iron ore requirements will be transported in maximum size design vessels. Therefore, a mix of vessels was used to derive annual transportation costs for both the base case and improved conditions.

Discussions with operating and managerial personnel at the lakefront transfer terminal have indicated several 1,000 X 105 vessels have entered the Outer Harbor during the 1980 navigation season carrying about 55,000 tons of pellets per trip. These capacities are now possible due to the present lake levels relative to Low Water Datum at this harbor. Also, the substantial monetary investment on the part of Republic Steel Corporation in this facility may represent an important economic motivation for operating Class X vessels into an Outer Harbor which was not originally designed to accommodate a vessel of this size. No specific engineering improvements for the Outer Harbor have been identified by either operational or managerial personnel at the Republic Steel transfer dock at this time. However, decreases in the

Table B30 - Future Outer Harbor Iron Ore Fleet

Vessel Name	Vessel Dimensions (feet)	Year Built	Mid-Summer Draft (feet)	Mid-Summer Capacity (Long Tons)
James R. Barker	1,004 X 105	1976	28'0"	59,700
Mesabi Miner	1,004 X 105	1977	28'0"	59,700
Elton Hoyt, 2nd	698 X 70	1952/1957 1/	26'11"	23,200
Charles Beeghly	806 X 75	1959/1972 1/	28'6"	32,500
(under construction)	1,000 X 105	1981	28'0" 2/	61,000 2/

1/ Indicates date of repowering, reconditioning, or lengthening. Both of these vessels will be converted to self-unloaders by the 1981 navigation season.

2/ Estimated based upon dimensions of other Class 10 vessels presently in service.

Sources: Greenwood's Guide to Great Lakes Shipping, 1979, and U. S. Merchant Marine Data Sheet, April 1980.

current lake stages may result in a reassessment of the physical capability of the existing Outer Harbor.

Engineering plans of improvement formulated for this Preliminary Feasibility Report utilize Low Water Datum as the design reference plane. Low Water Datum is a fixed reference plane selected by the United States and Canada so that a majority of time during the navigation season the actual levels of the Great Lakes will be above that plane. Low Water Datum for Lake Erie is defined as 568.6 feet above mean water levels at Father Point, QUE.

Safe and efficient navigation into the Outer Harbor at Lorain, OH, will require relocations of portions of the existing breakwaters and deepening and realignment of existing Federal channels. Design requirements and cost estimates are based upon minimum physical channel widths and depths plus consideration for vessel squat, roll, pitch, and heave requirements. Based upon design standards developed in Appendix A, a Class X vessel cannot enter the Outer Harbor at a GL/SLS safe system draft of 25.5 feet Low Water Datum unless future improvements are constructed.

Preliminary estimates of the extent of without-project draft utilization were calculated to be 21.5 feet and are based upon the design parameters developed in Appendix A Design and Cost Estimates. Unless proposed improvements are constructed, the long-term without-project conditions are expected to consist of the continued use of light-loaded Class X vessels.

All vessel sizes under improved conditions are assumed to be loaded to a maximum safe draft of 25.5 LWD due to constraints imposed upon downbound vessels (i.e., Vidal Shoals above the Soo Locks and the West Neebish Channel which is the designated channel for downbound vessels after they have locked through the Soo).

Iron ore movements to Republic Steel Corporation's lakefront dock site consist primarily of raw materials previously delivered to Cleveland Harbor, OH. Although Canadian traffic has also been handled at their Cleveland docks in the past, this tonnage does not usually comprise more than 10 percent of total annual receipts each year. A review of their domestic traffic unloaded at Cleveland Harbor for the account of Republic Steel for the period 1972-1978, is shown in Table B31. An overview of the harbors that have shipped domestic iron ore to the Republic docks at Cleveland, OH, is shown in Table B32.

Sourcing of raw materials are not expected to change as a result of completion of the Republic transshipment terminal at Lorain, OH. Therefore, about 97 percent of the 6,500,000 tons unloaded in the Outer Harbor would originate from ports above the Soo Locks during the planning period. About 3 to 5 percent of their annual traffic originates at Escanaba Harbor, MI, and would not be constrained by anticipated capacity problems at the Soo Locks.

B5.3 Transportation Costs Per Ton

Physical and financial characteristics for a range of vessel sizes, operating or expected to operate in the future, were utilized to evaluate the economic

Table B31 - Domestic Receipts of Iron Ore at Republic Steel Docks in Cleveland, OH

Origin	1978	1977	1976	1975	1974	1973	1972
Duluth, MN	341,552	388,224	30,699	11,239	370,634	182,034	0
Superior, WS	102,128	334,267	0	0	0	88,482	138,135
Silver Bay, WS	4,002,147	1,987,504	4,282,613	2,802,920	4,016,551	4,486,202	4,179,273
Taconite, MN	0	0	0	0	0	193,903	0
Presque Isle, MI	279,597	46,888	47,676	15,563	88,951	78,592	45,161
Escanaba, MI	131,730	196,907	75,967	399,903	250,920	70,330	315,737
Total	4,857,154	2,953,790	4,436,955	3,229,625	4,727,056	5,099,543	4,678,306

Source: Waterborne Commerce of the United States, Corps of Engineers.

Table B32 - Summary of Domestic Receipts by Origin Harbor
Cleveland Harbor, OH

	1978	1977	1976	1975	1974	1973	1972
	Percent Distribution						
Soo Locks Tonnage							
Duluth, MN	7	13	1	0.5	8	4	0
Superior, WI	2	11	0	0	0	2	3
Silver Bay, MN	82	67	96	87	85	88	89
Taconite, MN	0	0	0	0	0	4	0
Presque Isle, MI	6	2	1	0.5	2	1	2
Subtotal Soo Locks	97	93	98	88	95	99	94
Nonlock Tonnage							
Escanaba, MI	3	7	2	12	5	1	6
Total	100%	100%	100%	100%	100%	100%	100%

Source: Waterborne Commerce of the United States, Corps of Engineers.

Table B32A - Vessel Hourly Operating Cost Summary
270-Day Navigation Season

	Vessel Class					
	5	6	7	8	9	10
Construction Cost 1/	$27M	$30M	$34M	$38M	$48M	$59M
Annual Fixed Cost 2/	3,513,600	3,924,000	4,447,200	4,970,400	6,278,400	7,717,200
Daily Fixed Cost	13,080	14,530	16,470	18,410	23,250	28,580
Daily Operating Expense	14,280	15,380	15,900	13,470	20,730	21,520
Adjustment for Overhead (12%)	1,710	1,845	1,910	1,615	2,490	2,580
Daily Operating Expense	15,990	17,225	17,810	15,085	23,220	24,100
Total Daily Fixed and Operating	29,070	31,755	34,280	33,495	46,470	52,680
Hourly Operating Costs	1,210	1,323	1,428	1,395	1,936	2,195

1/ June 1980 price levels.
2/ Estimated using a capital recovery factor which yields an after tax return of 10 percent on original investment in vessel and assumed useful life of 50 years.

Source: Daily operating and estimated construction costs by vessel class were provided by Maritime Administration, U. S. Department of Commerce, 1979.

performance of future fleets. Required freight rates are defined as the transportation costs per ton which must be charged by the vessel owner/operator in order to cover all variable costs (i.e., daily vessel operating costs) and allow for recovery of their original investment in the vessel while earning a specified net rate of return on the total investment. Table B32A contains a summary of the financial costs used in the analysis.

Geographic distances between origin ports and Lorain Harbor, OH, and average speeds were used to estimate total annual vessel trips per year. Carrying capacities per trip for a range of drafts, up to the maximum design draft of 25.5 LWD were derived using tonnage immersion factors published in Greenwood's Guide to Great Lakes Shipping. Average speeds by vessel class, nominal estimates of loading and unloading times, and lock cycle and lock delay requirements were also included in the analysis. Minimum vessel movement time requirements for Class X vessels expected to operate on the Black River under improved conditions were obtained from prior coordination meetings with vessel masters and incorporated into the analysis.

Physical attributes of vessel sizes expected to utilize the harbor under existing or improved conditions and additional information on distances, speeds, and costs per ton by vessel class are summarized in Tables B33 and Table B34.

All of these factors were used to estimate the variation in vessel economics per ton for each alternative evaluated. A summary of vessel costs per ton for all plans of improvement are included in Table B35.

Changes in annual transportation costs per ton between existing and improved conditions must be further adjusted for all partial transshipment and lakefront transshipment alternatives. This is required to reflect the additional economic or financial costs required to move the iron ore unloaded at the lakefront to the upriver stockpiling areas. Variable costs per ton were derived for each specific type of alternative under consideration. For example, a plan for lakefront transshipment with an upriver conveyor would result in transportation savings attributed to the use of larger vessels but would require that an offset to the initial benefit be included. This cost would consist of the variable costs to operate and maintain a conveyor to move the iron ore to upriver ore docks. This would allow an assessment of the potential savings on an equivalent basis (i.e., from origin harbor-to-stockpile for both existing and improved conditions).

a. Upriver Ore Receipts. Total transportation costs to accommodate iron ore moving upriver to U. S. Steel Corporation are shown in Tables B36, B37, B38, B39, B40, and B41 and also include estimates of variable economic costs for each alternative. These costs are added to transportation costs under improved conditions and this subtotal is subsequently deducted from base case transportation costs to derive total net benefits attributed to larger vessels at Lorain Harbor, OH. The present value of future replacements for limited life items (i.e., conveyor belts, bearings, power units, etc.) for each alternative have been estimated and included as a component of the annual operation, maintenance, and replacement costs. This information can be reviewed in greater detail in Appendix A, Design and Cost Estimates.

Table B33 - Physical Attributes of Vessel Sizes
Lorain Harbor, OH

Vessel Class	Carrying Capacity 3/ Existing Conditions	Carrying Capacity 3/ Improved Conditions	Immersion Factor (Net Tons)	Mid-Summer Capability Capacity (Net Tons)	Mid-Summer Capability Draft (Feet)
Upriver					
Class 7	27,500	27,500	135	30,000	27'4"
Class 10	0 1/	59,200	245	66,000	27'10"
Outer Harbor					
Class 6	24,700	24,700	123	25,900	26'4"
Class 8	30,500	30,500	160	35,800	28'6"
Class 10	47,500 2/	59,200	245	66,000	27'10"

1/ Largest base case vessel on Black River is Class 7.

2/ Largest base case vessel in Outer Harbor is Class 10 light-loaded.

3/ Maximum draft for all vessels under improved conditions is 25.5 LWD.

Source: Maritime Administration, U. S. Department of Commerce and Greenwood's Guide to Great Lakes Shipping, 1979 Edition.

Table B34 - Physical Attributes of Iron Ore Movements to Lorain Harbor, OH

Vessel Class	Destination Within Harbor	Geographic Distance 1/	Nominal Loading/Unloading Time 2/ (Hours)	Lock Time Requirements (Hours)	Average Speed of Vessel (MPH)	Black River Vessel Time Requirements (Hours)	Vessel Trips per Year 5/	Annual Carrying Capacity 6/ Existing Conditions	Annual Carrying Capacity 6/ Improved Conditions
6	Lakefront	792	12	6.5 3/	15	0	52	1,284,400	1,284,400
7	Upriver	792	12	6.5 3/	15	3.0	51	1,402,500	1,402,500
8	Lakefront	792	12	6.5 3/	15	0	52	1,586,000	1,586,000
10	Lakefront	792	12	7.5 4/	15	0	52	2,470,000	3,078,400
10	Upriver	792	12	7.5 4/	15	6.0	49	0	2,900,800

1/ Round trip mileage from Greenwood's Guide to Great Lakes Shipping based upon distances between breakwater entrances.
2/ Loading and unloading times estimated at 6 hours each.
3/ Consists of 4 hours delay at locks plus 2.5 hours round trip lock cycle time.
4/ Consists of 4 hours delay at locks plus 3.5 hours round trip lock cycle time.
5/ Vessels expected to operate 24 hours each day during a 270-day navigation season. There is no allowance for down-time or maintenance during the warm weather months.
6/ Class 6, 7, and 8 vessels are expected to operate at 25.5 LWD under both existing or improved conditions.

Table B35 - Vessel Costs per Ton - Upriver Iron Ore

Vessel Class	Construction Cost 1/	Mid-Summer 2/ Draft	Mid-Summer 2/ Capacity	Total Hourly Operating Costs 3/	Capacity at 25.5 LWD 4/	Required Freight Rate	
				$		$	
7	$34M	27'4"	30,000	1,428	27,500	6.85	Base Case Black River Vessel
10	$59M	27'10"	66,000	2,195	59,200	5.75	Base Case Outer Harbor Vessel
10 (Direct Delivery)	$59M	27'10"	66,000	2,195	59,200	4.95	Alternatives 1, 2, 3, and 4
10 (Partial Transshipment)	$59M	27'10"	66,000	2,195	59,200	4.85	Alternatives 5, 6, 7, and 8
10 Lakefront Transshipment)	$59M	27'10"	66,000	2,195	59,200	4.65	Alternatives 9, 10, 11, and 12 Alternatives 13, 14, 15, and 16

1/ June 1980 price levels.
2/ Maritime Administration, U. S. Department of Commerce.
3/ Variable operating costs provided by the Maritime Administration. Annual costs estimated using a capital recovery factor based upon 10 percent rate of return after a corporate tax liability of 48 percent.
4/ Immersion relationships for each vessel class at 25.5 LWD are based upon conversion tables published in Greenwood's Guide to Great Lakes Shipping.

Table B36 - Direct Delivery of Upriver Iron Ore
Alternatives 1, 2, 3, and 4

	1980	1990	1995	2000	2010	2020	2030	2040	2045	Average Annual Equivalent Transportation Costs ($000's)
Traffic Forecast										
(Iron Ore Upriver)										
Unconstrained POE Lock	3,250,000	3,846,000	4,184,000	4,553,000	5,389,000	6,378,000	7,549,000	8,000,000	8,000,000	
Constrained POE Lock	3,250,000	3,846,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	
Base Case Vessel Class 7 1/										
Trip Capacity at 25.5										
Draft is 27,550 Net Tons										
Trips Per Year										
Unconstrained POE Lock	118	140	152	165	195	232	274	290	290	
Constrained POE Lock	118	140	152	152	152	152	152	152	152	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	22,262.5	26,345.1	28,660.4	31,188.1	36,914.7	43,689.3	51,710.7	54,800.0	54,800.0	36,225.4
Constrained POE Lock	22,262.5	26,345.1	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4
Design Vessel Class 10 2/										
Trip Capacity at 25.5										
Draft is 58,900 Net Tons										
Trips Per Year										
Unconstrained POE Lock	55	65	71	77	91	108	128	136	136	
Constrained POE Lock	55	65	71	71	71	71	71	71	71	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	16,087.5	19,037.7	20,710.8	22,537.4	26,675.6	31,571.1	37,367.6	39,600.0	39,600.0	26,183.2
Constrained POE Lock	16,087.5	19,037.7	20,710.8	20,710.8	20,710.8	20,710.8	20,710.8	20,710.8	20,710.8	20,710.8

1/ Mid-summer draft is 27 feet, 4 inches; mid-summer capacity is 30,000 net tons; tons per inch immersion factor is 135 net tons.
2/ Mid-summer draft is 27 feet, 10 inches; mid-summer capacity is 66,000 net tons; tons per inch immersion factor is 244 net tons.

Table B37 - Partial Transshipment at 21st Street Bridge for Upriver Iron Ore Alternatives 5, 6, 7, and 8

	1980	1990	1995	2000	2010	2020	2030	2040	2045	Average Annual Equivalent Transportation Costs ($000's)
Traffic Forecast (Iron Ore Upriver)										
Unconstrained POE Lock	3,250,000	3,846,000	4,184,000	4,553,000	5,389,000	6,278,000	7,549,000	8,000,000	8,000,000	
Constrained POE Lock	3,250,000	3,846,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	
Base Case Vessel Class 7 1/ Trip Capacity at 25.5 Draft is 27,550 Net Tons										
Trips Per Year										
Unconstrained POE Lock	118	140	152	165	196	232	274	290	290	
Constrained POE Lock	118	140	152	152	152	152	152	152	152	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	22,262.5	26,345.1	28,660.4	31,188.1	36,914.7	43,689.3	51,710.7	54,800.0	54,800.0	36,225.4
Constrained POE Lock	22,262.5	26,345.1	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,460.4
Design Vessel Class 10 2/ Trip Capacity at 25.5 Draft is 58,900 Net Tons										
Trips Per Year										
Unconstrained POE Lock	55	65	71	77	91	108	128	136	136	
Constrained POE Lock	55	65	71	71	71	71	71	71	71	
Transportation Costs $000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,762.5	18,653.1	20,292.4	22,082.1	26,136.7	30,933.3	36,612.7	38,800.0	38,800.0	
Constrained POE Lock	15,762.5	18,653.1	20,292.4	20,292.4	20,292.4	20,292.4	20,292.4	20,292.4	20,292.4	
Variable Operation Costs Conveyor ($000)	$ 0	$ 0	$ 1,767.7	$ 1,866.7	$ 2,074.8	$ 2,264.2	$ 2,415.7	$ 2,400.0	$ 2,440.0	
Total Annual Transportation Costs 3/ ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,762.5	18,653.1	22,060.1	23,948.8	28,211.5	33,197.5	39,028.4	41,200.0	41,200.0	27,668.6
Constrained POE Lock	15,762.5	18,653.1	22,060.1	22,060.1	22,060.1	22,060.1	22,060.1	22,060.1	22,060.1	22,060.1

1/ Mid-summer draft is 27 feet, 4 inches; mid-summer capacity is 30,000 net tons; tons per inch immersion factor is 135 net tons.
2/ Mid-summer draft is 27 feet, 10 inches; mid-summer capacity is 66,000 net tons; tons per inch immersion factor is 244 net tons.
3/ Equals sum of vessel transportation costs plus variable operating costs for conveyor.

Table B19 - Lakefront Transshipment With Upriver Conveyor for Upriver Iron Ore
Alternatives 9 and 13

	1980	1990	1995	2000	2010	2020	2030	2040	2045	Average Annual Equivalent Transportation Costs ($000's)
Traffic Forecast (Iron Ore Upriver)										
Unconstrained POE Lock	3,250,000	3,846,000	4,184,000	4,553,000	5,389,000	6,378,000	7,549,000	8,000,000	8,000,000	
Constrained POE Lock	3,250,000	3,846,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	
Base Case Vessel Class 7 1/ Trip Capacity at 25.5 Draft is 27,550 Net Tons										
Trips Per Year										
Unconstrained POE Lock	118	140	152	165	196	232	274	290	290	
Constrained POE Lock	118	140	152	152	152	152	152	152	152	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	22,262.5	26,345.1	28,660.4	31,188.1	36,914.7	43,689.3	51,710.7	54,800.0	54,800.0	36,225.4
Constrained POE Lock	22,262.5	26,345.1	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4
Design Vessel Class 10 2/ Trip Capacity at 25.5 Draft is 58,900 Net Tons										
Trips Per Year										
Unconstrained POE Lock	55	65	71	77	91	108	128	136	136	
Constrained POE Lock	55	65	71	71	71	71	71	71	71	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	19,455.6	21,171.5	25,058.9	29,657.7	35,102.9	37,200.0	37,200.0	
Constrained POE Lock	15,112.5	17,883.9	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	
Variable Operation Costs Conveyor 3/ ($000)	$ 0	$ 0	$ 2,667.3	$ 2,777.3	$ 3,071.7	$ 3,364.4	$ 3,604.6	$ 3,624.8	$ 3,624.8	
Total Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	22,122.9	23,948.8	28,130.6	33,022.1	38,707.5	40,824.8	40,824.8	27,597.6
Constrained POE Lock	15,112.5	17,883.9	22,122.9	22,122.9	22,122.9	22,122.9	22,122.9	22,122.9	22,122.9	22,122.9

1/ Mid-summer draft is 27 feet, 4 inches; mid-summer capacity is 30,000 net tons; tons per inch immersion factor is 135 net tons.
2/ Mid-summer draft is 27 feet, 10 inches; mid-summer capacity is 66,000 net tons; tons per inch immersion factor is 244 net tons.
3/ Equals sum of vessel transportation costs plus variable operating costs for conveyor.

Table B39 - Lakefront Transshipment With Special Purpose Vessel for Upriver Iron Ore
Alternatives 10 and 14

	1980	1990	1995	2000	2010	2020	2030	2040	2045	Average Annual Equivalent Transportation Costs ($000's)
Traffic Forecast										
(Iron Ore Upriver)										
Unconstrained POE Lock	3,250,000	3,846,000	4,184,000	4,553,000	5,389,000	6,378,000	7,549,000	8,000,000	8,000,000	
Constrained POE Lock	3,250,000	3,846,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	
Base Case Vessel Class 7 1/										
Trip Capacity at 25.5										
Draft is 27,550 Net Tons										
Trips Per Year										
Unconstrained POE Lock	118	140	152	165	196	232	274	290	290	
Constrained POE Lock	118	140	152	152	152	152	152	152	152	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	22,262.5	26,345.1	28,660.4	31,188.1	36,914.7	43,689.3	51,710.7	54,800.0	54,800.0	36,225.4
Constrained POE Lock	22,262.5	26,345.1	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4
Design Vessel Class 10 2/										
Trip Capacity at 25.5										
Draft is 58,900 Net Tons										
Trips Per Year										
Unconstrained POE Lock	55	65	71	77	91	108	128	136	136	
Constrained POE Lock	55	65	71	71	71	71	71	71	71	
Transportation Costs $000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	19,455.6	21,171.5	25,058.9	29,657.7	35,102.9	37,200.0	37,200.0	
Constrained POE Lock	15,112.5	17,883.9	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	
Variable Operation and										
Maintenance Cost 3/ $000)	$	$	$	$	$	$	$	$	$	
Conveyor	0	0	4,769.8	5,008.3	5,389.0	5,612.6	5,661.8	5,545.0	5,545.0	
Special Purpose Vessel	0	0	999.6	1,082.9	1,285.2	1,523.2	1,785.0	1,904.0	1,904.0	
Subtotal Variable O&M			5,769.4	6,079.2	6,674.2	7,135.8	7,446.0	7,449.0	7,449.0	
Total Transportation Costs	$	$	$	$	$	$	$	$	$	
($000)										
Unconstrained POE Lock	15,112.5	17,883.9	25,225.0	27,262.7	31,733.1	36,793.5	42,549.7	44,649.0	44,649.0	31,127.7
Constrained POE Lock	15,112.5	17,883.9	25,225.0	25,225.0	25,225.0	25,225.0	25,225.0	25,225.0	25,225.0	25,225.0

1/ Mid-summer draft is 27 feet, 4 inches; mid-summer capacity is 30,000 net tons; tons per inch immersion factor is 135 net tons.
2/ Mid-summer draft is 27 feet, 10 inches; mid-summer capacity is 66,000 net tons; tons per inch immersion factor is 244 net tons.
3/ Equals sum of vessel transportation costs plus variable operating costs for conveyor.

Table B40 - Lakefront Transshipment With Rail Movement Upriver for Upriver Iron Ore
Alternatives 11 and 15

	1980	1990	1995	2000	2010	2020	2030	2040	2045	Average Annual Equivalent Transportation Costs ($000's)
Traffic Forecast										
(Iron Ore Upriver)										
Unconstrained POE Lock	3,250,000	3,846,000	4,184,000	4,553,000	5,389,000	6,378,000	7,549,000	8,000,000	8,000,000	
Constrained POE Lock	3,250,000	3,846,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	
Base Case Vessel Class 7 1/										
Trip Capacity at 25.5										
Draft is 27,550 Net Tons										
Trips Per Year										
Unconstrained POE Lock	118	140	152	165	196	232	274	290	290	
Constrained POE Lock	118	140	152	152	152	152	152	152	152	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	22,262.5	26,345.1	28,660.4	31,188.1	36,914.7	43,689.3	51,710.7	54,800.0	54,800.0	36,225.4
Constrained POE Lock	22,262.5	26,345.1	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4
Design Vessel Class 10 2/										
Trip Capacity at 25.5										
Draft is 58,900 Net Tons										
Trips Per Year										
Unconstrained POE Lock	55	65	71	77	91	108	128	136	136	
Constrained POE Lock	55	65	71	71	71	71	71	71	71	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	19,455.6	21,171.5	25,058.9	29,657.7	35,102.9	37,200.0	37,200.0	
Constrained POE Lock	15,112.5	17,883.9	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	
Variable Operation Cost	$	$	$	$	$	$	$	$	$	
Conveyor 3/ ($000)	0	0	2,175.7	2,310.6	2,532.8	2,790.4	2,981.9	3,015.0	3,015.0	
Rail Movements	0	0	1,207.5	1,229.6	1,279.2	2,310.4	2,371.0	2,398.6	2,398.6	
Subtotal Variable Operating Costs			3,383.2	3,540.2	3,812.0	5,100.8	5,352.9	5,413.6	5,413.6	
Total Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	22,838.8	24,711.7	28,870.9	34,758.5	40,455.8	42,613.6	42,613.6	28,551.9
Constrained POE Lock	15,112.5	17,883.9	22,838.8	22,838.8	22,838.8	22,838.8	22,838.8	22,838.8	22,838.8	22,838.8

1/ Mid-summer draft is 27 feet, 4 inches, mid-summer capacity is 30,000 net tons; tons per inch immersion factor is 135 net tons.
2/ Mid-summer draft is 27 feet, 10 inches; mid-summer capacity is 66,000 net tons; tons per inch immersion factor is 244 net tons.
3/ Equals sum of variable railroad costs plus variable operating costs for conveyor.

Table B41 - Lakefront Transshipment With Truck Haul Upriver for Upriver Iron Ore
Alternatives 12 and 16

	1980	1990	1995	2000	2010	2020	2030	2040	2045	Average Annual Equivalent Transportation Costs ($000's)
Traffic Forecast										
(Iron Ore Upriver)										
Unconstrained POE Lock	3,250,000	3,846,000	4,184,000	4,553,000	5,389,000	6,378,000	7,549,000	8,000,000	8,000,000	
Constrained POE Lock	3,250,000	3,846,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	4,184,000	
Base Case Vessel Class 7 1/										
Trip Capacity at 25.5										
Draft is 27,550 Net Tons										
Trips Required										
Unconstrained POE Lock	118	140	152	165	196	232	274	290	290	
Constrained POE Lock	118	140	152	152	152	152	152	152	152	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	22,262.5	26,345.1	28,660.4	31,188.1	36,914.7	43,689.3	51,710.7	54,800.0	54,800.0	36,225.4
Constrained POE Lock	22,262.5	26,345.1	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4	28,660.4
Design Vessel Class 10 2/										
Trip Capacity at 25.5										
Draft is 58,900 Net Tons										
Trips Per Year										
Unconstrained POE Lock	55	65	71	77	91	108	128	136	136	
Constrained POE Lock	55	65	71	71	71	71	71	71	71	
Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	19,455.6	21,171.5	25,058.9	29,657.7	35,102.9	37,200.0	37,200.0	
Constrained POE Lock	15,112.5	17,883.9	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	19,455.6	
Variable Operation Cost	$	$	$	$	$	$	$	$	$	
Conveyor 3/ ($000)	0	0	3,685.5	3,924.4	4,468.5	5,024.0	5,550.0	5,740.0	5,740.0	
Truck Movements	0	0	2,268.0	2,592.0	2,916.0	3,564.0	4,212.0	4,536.0	4,536.0	
Subtotal Variable Operating Costs			5,953.5	6,516.4	7,384.5	8,544.0	9,762.0	10,276.0	10,276.0	
Total Transportation Costs ($000)	$	$	$	$	$	$	$	$	$	
Unconstrained POE Lock	15,112.5	17,883.9	25,409.1	27,687.8	32,443.4	38,201.7	44,864.9	47,476.0	47,476.0	31,882.8
Constrained POE Lock	15,112.5	17,883.9	25,409.1	25,409.1	25,409.1	25,409.1	25,409.1	25,409.1	25,409.1	25,409.1

1/ Mid-summer draft is 17 feet, 4 inches; mid-summer capacity is 30,000 net tons; tons per inch immersion factor is 135 net tons.
2/ Mid-summer draft is 27 feet, 10 inches; mid-summer capacity is 66,000 net tons; tons per inch immersion factor is 244 net tons.
3/ Equals sum of truck costs plus variable operating costs for conveyor.

Table B42 - Summary of Net Transportation Savings for Upriver Iron Ore

Transportation Concept	Average Annual Transportation Costs: Existing Conditions ($000)	Average Annual Transportation Costs: Improved Conditions ($000)	Average Annual Transportation Costs: Transportation Savings 1/ ($000)
Direct Delivery			
Unconstrained POE	36,225.4	26,183.2	10,042.2
Constrained POE	28,660.4	20,710.8	7,949.6
Partial Transshipment			
Unconstrained POE	36,225.4	27,668.6	8,556.8
Constrained POE	28,660.4	22,060.1	6,600.3
Lakefront Transshipment			
Alternatives 9 and 13			
Unconstrained POE	36,225.4	27,597.6	8,627.8
Constrained POE	28,660.4	22,122.9	6,5[illegible]7.5
Alternatives 10 and 14			
Unconstrained POE	36,225.4	31,127.7	5,097.7
Constrained POE	28,660.4	25,225.0	3,435.4
Alternatives 11 and 15			
Unconstrained POE	36,225.4	28,551.9	7,673.5
Constrained POE	28,660.4	22,838.8	5,821.6
Alternatives 12 and 16			
Unconstrained POE	36,225.4	31,882.8	4,342.6
Constrained POE	28,660.4	25,409.1	3,251.3

1/ Net of variable operation and maintenance costs for partial transshipment and lakefront transshipment alternatives.

Direct delivery of the upriver iron ore produces the greatest annual transportation savings. However, both of these transportation concepts require the largest investment of financial resources to accommodate movements of Class X vessels on the Black River. Lakefront transshipment concepts provide a lower level of annual transportation savings but require relatively small investments. Also, operating and maintenance costs are variable with tonnage throughput for lakefront plans which also reduces the average annual transportation costs for the lakefront transshipment concepts. Net transportation savings attributed to various plans of improvement have been summarized in Table B42.

b. Lakefront Ore Receipts. Benefit evaluation of future iron ore receipts at the new Republic transfer dock have been based upon the expected increase in vessel carrying capacity as a result of deeper drafts in the Lake Approach Channel. A detailed discussion of the channel design and other related physical requirements for Class 10 vessels can be found in Appendix A. An engineering evaluation of existing conditions concluded that construction of the proposed modification in the existing Outer Harbor would facilitate upriver ore receipts to U. S. Steel Corporation by increasing usable drafts an additional 4 feet. Changes in trip capacities are expected to produce substantial vessel economies of scale. This improvement will also allow more tons to be moved to the lakefront ore dock by Class 10 vessels each year at a lower overall annual cost per ton. A detailed evaluation of the potential benefits for Outer Harbor iron ore is presented below.

Iron ore that is unloaded on the west bank of the Black River consists of iron ore receipts that were either previously handled at Cleveland Harbor, OH, for local consumption by Cuyahoga River steel plants and ore which was previously transshipped at several Lake Erie harbors to Republic Steel plants located in the Warren-Youngstown, OH, area. This has resulted in a consolidation of Republic Steel iron ore flows from Lake Erie ports to their Outer Harbor dock in Lorain Harbor, OH. Navigation improvement projects for the Outer Harbor can potentially produce substantial annual transportation savings since even very small savings per ton will be magnified in light of the 6.5 million tons expected to shift over to this harbor by project year one (1995).

Transportation costs under existing conditions have been derived using constructed transportation costs per ton in a manner similar to upriver ore costs discussed previously. Additional refinements to the analysis were necessary to include possible utilization of maximum design vessels supplemented by smaller vessels (Class 6 and Class 8) by the shipping company presently under contract to Republic Steel. Total transportation costs are derived on the assumption that these smaller vessels are likely to participate in moving iron ore from the upper lakes ports of origin to Lorain Harbor, OH. These costs per ton by vessel size are summarized in Table B43.

Three Class 10 vessels are expected to be operating in this company's fleet by 1981 although only two Class 10 vessels have been used to derive annual transportation costs under existing conditions. Estimated annual tons to be carried by these maximum design vessels were deducted from the total annual volume to be shipped and distributed among the smaller vessels after consideration of their annual trip capacity and relative cost advantages. This arbitrary distribution among available ship sizes is only one possible scenario of vessel utilization and may not be indicative of realworld constraints such as profitability of alternate trade routes, availability of vessels, unscheduled maintenance and other factors that might affect the use of individual vessels within the Interlake Steamship Company Great Lakes fleet.

Transportation benefits under improved conditions are evaluated as the potential vessel savings which could be realized as Class 10 vessels increase their annual carrying capacity and trip capacity in response to deeper

Table B43 - Vessel Costs Per Ton - Lakefront Iron Ore

Vessel Class	Construction Cost 1/	Mid-Summer 2/ Draft	Mid-Summer 2/ Capacity	Total Hourly Operating Costs 3/	Trip Capacity at 25.5 LWD 4/ (Net Tons)	Annual Transport Capability (Net Tons)	Required Freight Rate
	$			$			$
10 (Light-Load)	59,000,000	27'10"	66,000	2,195	47,500	2,470,000	5.75
6	30,000,000	26'4"	25,900	1,323	24,700	1,284,000	6.65
8	38,000,000	28'6"	35,800	1,395	30,500	1,586,000	5.70
10	59,000,000	27'10"	66,000	2,195	59,200	3,062,800	4.65

1/ June 1980 price levels

2/ Maritime Administration, U.S. Department of Commerce

3/ Variable operating costs provided by the Maritime Administration. Annual costs estimated using a capital recovery factor to yield an after tax return of 10 percent on investment in a vessel which has a service life of 50 years.

4/ Immersion relationships for each vessel class at 25.5 LWD are based upon conversion tables published in Greenwoods Guide to Great Lakes Shipping, 1979 edition.

drafts. Under these conditions less tonnage will be available to be moved by smaller vessels. Specifically, Class 8 vessels are expected to carry 500,000 tons less each year while Class 6 vessels are unlikely to carry any significant portion of annual iron ore requirements. The overall decrease in annual transportation costs between existing and improved conditions is summarized in Table B44.

Table B44 - Lakefront Transshipment at Republic Steel Dock

	1995	2000	2010	2020	2030	2040	2045	Annual Carrying Capacity (Net Tons)	Equivalent Average Annual Transportation Costs
	$	$	$	$	$	$	$		$
Traffic Forecast									
Iron Ore Receipts at Outer Harbor 1/	6,500,000	6,500,000	6,500,000	6,500,000	6,500,000	6,500,000	6,500,000		
Existing Channel Depths (29 LWD) 2/									
1,000 X 105 (Class 10)	27,600,000	27,600,000	27,600,000	27,600,000	27,600,000	27,600,000	27,600,000	4,800,000	
805 X 75 (Class 8)	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	1,000,000	
698 X 70 (Class 6)	4,655,000	4,655,000	4,655,000	4,655,000	4,655,000	4,655,000	4,655,000	700,000	
Total Transportation Costs	37,955,000	37,955,000	37,955,000	37,955,000	37,955,000	37,955,000	37,955,000		37,955,000
Improved Channel Depths (32 LWD) 3/									
1,000 X 105 (Class 10)	27,900,000	27,900,000	27,900,000	27,900,000	27,900,000	27,900,000	27,900,000	6,000,000	
805 X 75 (Class 8)	2,850,000	2,850,000	2,850,000	2,850,000	2,850,000	2,850,000	2,850,000	500,000	
Total Transportation Costs	30,750,000	30,750,000	30,750,000	30,750,000	30,750,000	30,750,000	30,750,000		30,750,000

1/ No growth forecasted for iron ore receipts at lakefront transfer terminal.

2/ Three Class 10 vessels will be operated by Pickands Mather & Co. by project year one. However, only two vessels have been assumed to be dedicated for the Outer Harbor dock. Class 8 and Class 6 vessels are assumed to operate at 25.5 LWD under existing and improved conditions.

3/ Class 10 vessels increase their trip capacity to 58,900 net tons at 25.5 LWD. This increased efficiency decreases cost per ton and increases their annual carrying capacity to about 3,000,000 tons per vessel. Balance of .5 million tons can be transported by Class 8 vessel. Class 6 vessel is expected to be displaced due to economies of scale by next largest vessel size.

B6. IMPACTS ON AMERICAN SHIPBUILDING CORPORATION

Economic benefits attributed to a plan of improvement which would facilitate design vessel movements to and from the American Shipbuilding dry docks were measured as the elimination of tug-assistance charges. Vessel movements under existing conditions require tug assistance whenever 1,000-foot vessels pass under the Erie Avenue Bridge. Vessel transits to the American Shipbuilding dry docks result from enforcement of Coast Guard requirements for periodic vessel hull inspections, new vessel launchings and the extent of emergency vessel repair and maintenance. This economic evaluation is restricted to future vessel movements associated with 1,000-foot vessel launchings and required 5-year hull inspections.

B6.1 Future Vessel Construction

A forecast of new vessel construction was developed using a fleet aging process for both the existing maximum size ships operating in 1980 and the expected number of new vessels to be constructed within the GL/SLS. Additional vessels to be built in the future were allocated between Lorain, OH, and Sturgeon Bay, WI, shipyards. Actual construction schedules at individual shipyards are difficult to estimate. The demand for these vessels was subsequently divided between each shipyard such that Lorain, OH, would build a new design vessel every other year. A summary of new vessel construction is included in Table B45.

Table B45 - Construction Schedule for Maximum Size Vessels in the GL/SLS System

Interval	New Vessel Launchings	Interval	New Vessel Launchings
1995 - 2000	5	2020 - 2025	3
2000 - 2005	2	2025 - 2030	8
2005 - 2010	3	2030 - 2035	11
2010 - 2015	5	2035 - 2040	7
2015 - 2020	3	2040 - 2045	9

Source: MAXIMUM SHIP SIZE STUDY, North Central Division, Corps of Engineers, 1977.

It was reported that the launching of the JAMES R. BARKER in 1976 required assistance by six tugboats to leave the dry dock, pass under the Erie Avenue Bridge, and enter the Outer Harbor. The financial costs of this tug assistance were estimated to be about $60,000. For purposes of establishing the benefits which might accrue to the shipyard, it was assumed that any plan for replacement of the existing Erie Avenue Bridge in conjunction with related bank cuts to accommodate realignment of an improved navigation channel or construction of a new Riverside Park entrance channel would effectively

eliminate these additional vessel launching costs. The present discounted value of the future ship launching costs expected to prevail under the base case condition is based upon potential tug assistance costs of $60,000 per vessel launching and a construction schedule of one new ship every other year. 1/ The discounted present value of these future savings is estimated to be $379,400. Average annual savings are equal to the present worth amortized over the 50-year evaluation period. This is equal to $379,400 X .07591, or $28,800 discounted average annual savings.

B6.2 Future Hull Inspections

The Department of Transportation has established rules and regulations for cargo vessels operating on the Great Lakes. These requirements are enforced by the U. S. Coast Guard and consist of general safety standards and related performance criteria that vessel owner-operators must comply with before their vessels are allowed to operate each year. Among these standards is a requirement for a periodic drydocking and examination of each vessel depending upon its operating environment (i.e., salt water versus fresh water).

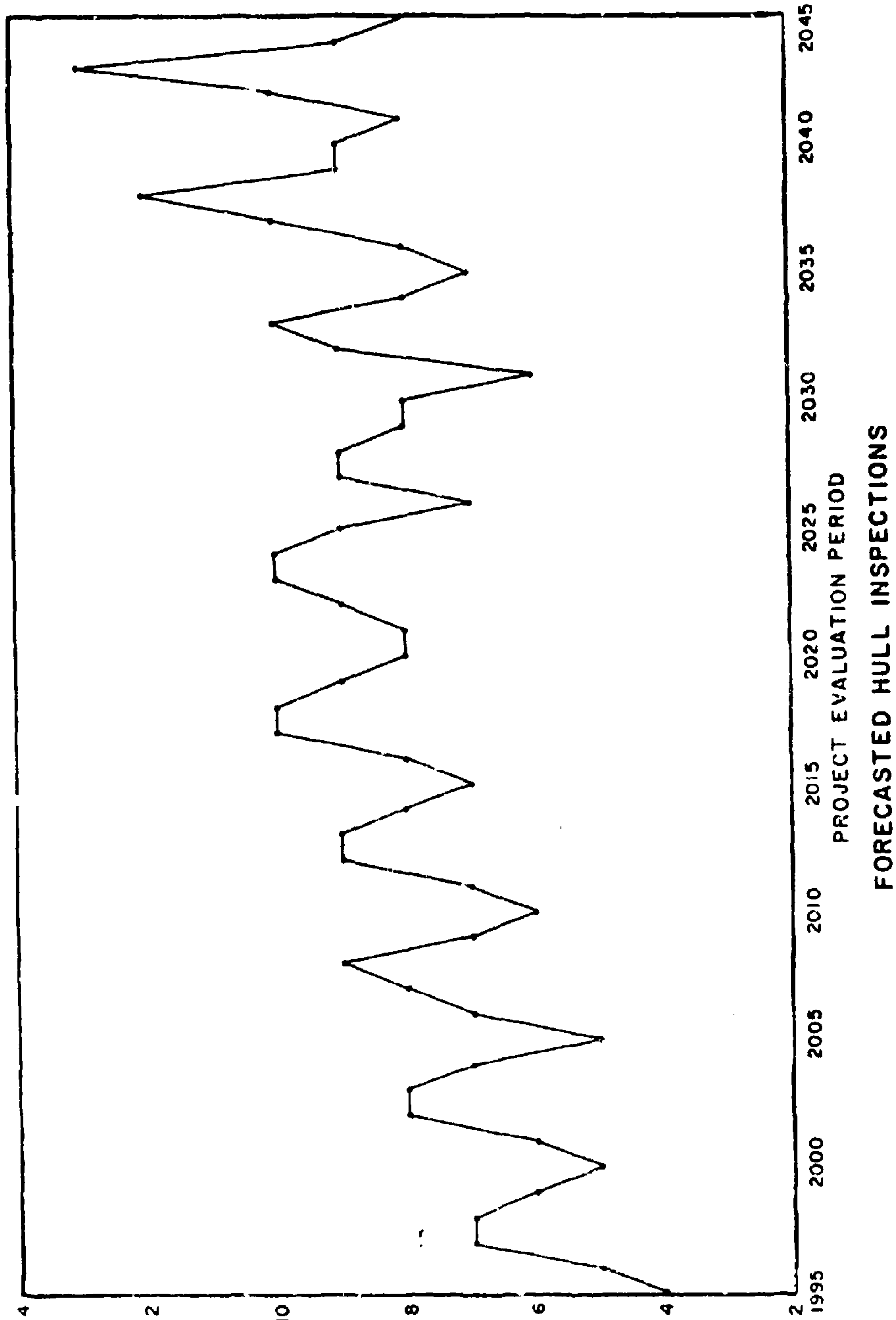
"Each vessel shall be drydocked or hauled out at intervals not to exceed 60 months if it operates exclusively in fresh water or if it operates in salt water an aggregate not exceeding 1 month in each 12-month period since it was last drydocked or hauled out."2/

The requirement of a hull inspection every 5 years after a vessel is constructed will result in an increasing demand over time for accessibility for shipyard dry docks. Only two shipyards, Lorain, OH, and Sturgeon Bay, WI, are expected to participate in the required hull inspection program. A third facility is located in Erie, PA, and can accommodate 1,000-foot vessels, however, the future availability of this site has been deferred until the Final Feasibility Report.

Demand for future annual hull inspections are based upon the existing number of 1,000 X 105-foot vessels presently in operation and the forecast of new supercarriers projected in the MAXIMUM SHIP SIZE STUDY. Forecasts of the number of new vessels to be constructed between each point in time were used to prepare a distribution of required hull inspections during the project planning period. There will be a minimum of five and a maximum of 13 annual mandatory 1,000-foot vessel lay-ups within the GL/SLS system each year. A graphical summary of the annual demand for access to Great Lakes drydocks during the project evaluation period is shown in Figure B5.

1/ Present worth of a periodically recurring future cost is equal to $\frac{(1-(1/1+i)^{MN})}{((1+i)^{M} - 1.0)}$ where M is the vessel construction interval in years and N is length of project (50 years) divided by the vessel construction interval (i.e., 2 years). The result from this calculation is subsequently multiplied by the unit cost of $60,000.

2/ Title 46, CFR, Part 91, "Inspection and Certification" (September 1977); Coast Guard Rules and Regulations for Cargo and Miscellaneous Vessels, U. S. Department of Transportation.



REQUIRED HULL INSPECTIONS

FIGURE B5

A conflict could develop at any one shipyard if the existing graving docks are already occupied by a maximum design vessel under construction at the same time another vessel must be inspected. This analysis assumes that sufficient dry dock facilities will be available within the Lorain, OH, shipyard to accommodate its share of the annual Great Lakes hull inspection schedule and a lack of any external constraint to this inspection process. Expansion of the American Shipbuilding Inc., dry docks are already underway as part of a $4 million redevelopment program announced in March 1980. Additional information can be obtained by a review of a recent news release in Appendix E.

It is expected that each vessel trip into the Lorain shipyard can be accomplished at a lower cost per trip than the new vessel launchings. Therefore, a reduced level of savings per vessel movement was used to evaluate the economic costs incurred by vessel operators who enter and exit the shipyard to comply with the 5-year hull inspection program. The rationale for this approach is based upon the expectation that existing vessels will be operating with an experienced crew and vessel master under full power relative to a partially equipped new 1,000-foot vessel that is just emerging from a drydock.

Incremental vessel costs which would be incurred for each hull inspection are estimated to be one-half of the total costs to launch a new vessel. The long-term annual average number of hull inspections at the American Shipbuilding facility is estimated to be four vessels per year. This level of activity would be equivalent to an annual cost of $120,000 which could be eliminated by construction of the new Riverside Park cut or modification of the existing Erie Avenue Bridge and construction of associated bank cuts.

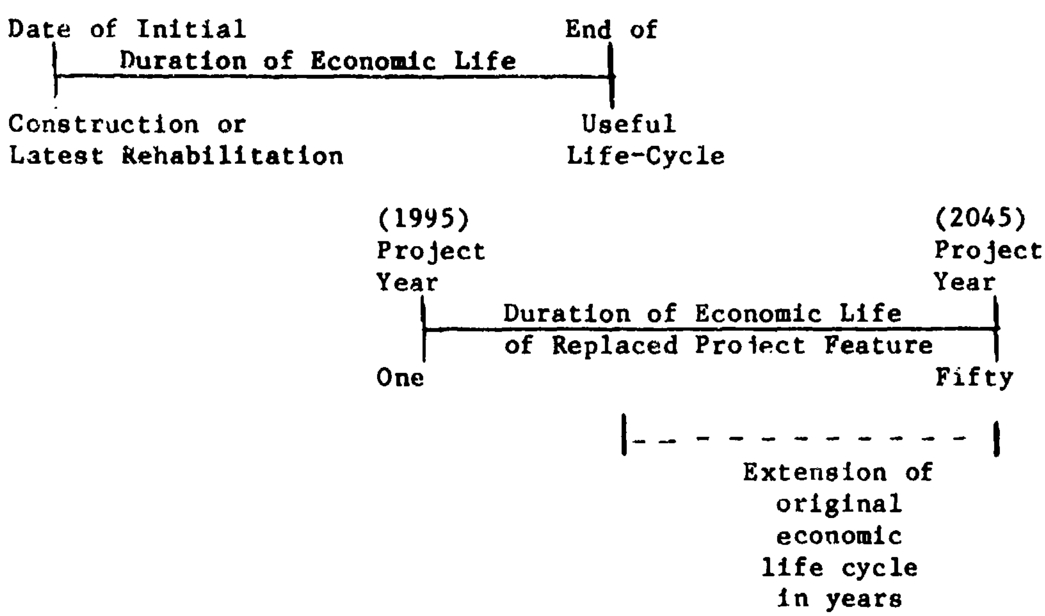
Total average annual drydock related savings for proposed modifications at the entrance to the Black River consist of elimination of both tug-assistance costs for new vessels and costs incurred to comply with Coast Guard requirements for periodic hull inspections. Total average annual savings for both of these activities are estimated to be $148,800 ($120,000 for hull inspection costs avoided and $28,800 for future vessel launchings).

B7. ADVANCE REPLACEMENTS

Three bridges cross the Black River in the reach between the river mouth and the upstream limit of navigation. Two of these are vehicular bridges while the third is a lift bridge which has recently been modified by the Norfolk and Western Railroad. Both vehicular bridges were constructed about 1940 and are now at or beyond their original engineering life-cycle. Engineering feasibility studies have been initiated by local interests to identify the options available to them in terms of rehabilitation or replacement of the existing structures. The recommended improvements will be dependent upon the availability of funds from county, State or Federal sources. However, it is very likely that both of these bridges will be substantially modified or replaced in kind in the very near future. The design life of these new structures is expected to be about 50 years. These structures, if replaced in the next few years, would be about 10 years old by project year one (i.e., 1995).

Implementation of any plan of improvement which includes a bridge replacement or rehabilitation component would extend the economic or useful life of these bridges. Whenever a project involves replacement of an existing project-related feature thus extending the period during which benefits will be realized beyond that for which the existing improvement would have continued to function, an adjustment is necessary to credit the project with the resulting extension of benefits.

The full cost of the replaced feature is included as a project cost and adjustments to estimated benefits will be made, using the applicable project interest rate, as shown in the schematic diagram below.



A summary of the individual calculations used to derive estimated advance replacement benefits for each plan of improvement are included in Table B46.

Table B46 - Calculation of Advance Replacement Benefits

Alternative Number	Estimated First Cost 1/	Average Annual Costs 2/	Present Worth of $1 Per Period 3/	Present Worth Factor 4/	Amortization Factor 5/	Average Annual Advance Replacement Benefits
	$	$				$
2	76,800,000	5,830,300	6.903	.058	.07591	177,200
3	60,100,000	4,563,300	6.903	.058	.07591	138,700
4	99,900,000	7,585,100	6.903	.058	.07591	230,500
6	35,600,000	2,699,900	6.903	.058	.07591	82,100
7	18,900,000	1,432,700	6.903	.058	.07591	43,500
8	58,700,000	4,455,600	6.903	.058	.07591	135,400

1/ Subtotal of bridge replacements or bridge modifications.
2/ Estimated at May 1980 prices.
3/ Present worth of $1 for ten periods (i.e., number of periods equal to the extended life-cycle).
4/ Present value factor for $1 due 40 years in future.
5/ Amortization factor for a 50-year period at project interest rate of 7.375 percent.

B8. SUMMARY OF TOTAL NED BENEFITS

Vessel transportation savings for upriver and lakefront iron ore movements have been evaluated as the potential vessel economies which could be realized by increasing the effective carrying capacities of Class IX self-unloading vessels or increases in the size of the base case vessel. Channel modifications or bridge replacements may also result in economic savings at the American Shipbuilding dry docks. Advance replacement benefits may also be a potential benefit for any alternative which includes a bridge modification or replacement. Total benefits for each alternative are summarized in Table B47 and a comparison of benefits, costs, net benefits and benefit-to-cost ratio is presented in Table B48.

Table B47 - Summary of Benefits 1/

Alt. No.	Upriver Iron Ore Transportation Savings		American Shipbuilding Launchings and Hull Inspections	Advance Replacements	Lakefront Iron Ore Transportation Rate Savings	Total Benefits	
	Constrained POE	Unconstrained POE				Constrained POE Locks	Unconstrained POE Locks
1	7,949,600	10,042,200	148,800	0	7,205,000	15,303,400	17,396,000
2	7,949,600	10,042,200	148,800	177,200	7,205,000	15,480,600	17,573,200
3	7,949,600	10,042,200	148,800	138,700	7,205,000	15,442,100	17,534,700
4	7,949,600	10,042,200	148,800	230,500	7,205,000	15,533,900	17,626,500
5	6,600,300	8,556,800	148,800	0	7,205,000	13,954,100	15,910,600
6	6,600,300	8,556,800	148,800	82,100	7,205,000	14,036,200	15,991,900
7	6,600,300	8,556,800	148,800	43,500	7,205,000	13,997,600	15,954,100
8	6,600,300	8,556,800	148,800	135,400	7,205,000	14,089,500	16,046,000
9	6,537,500	8,627,800	0	0	7,205,000	13,742,500	15,832,800
13	6,537,500	8,627,800	148,800	0	7,205,000	13,891,300	15,981,600
10	3,435,400	5,097,700	0	0	7,205,000	10,640,400	12,302,700
14	3,435,400	5,097,700	148,800	0	7,205,000	10,789,200	12,451,500
11	5,821,600	7,647,900	0	0	7,205,000	13,026,600	14,852,900
15	5,821,600	7,647,900	148,800	0	7,205,000	13,175,400	15,001,700
12	3,251,300	4,342,600	0	0	7,205,000	10,456,300	11,547,600
16	3,251,300	4,342,600	148,800	0	7,205,000	10,605,100	11,696,400

1/ 1980 price levels and 7.375 project interest rate.

Table B48 - Summary Economic Evaluation by Plan
Lorain Harbor, OH

Alternative Number	Total Average Annual Benefits Unconstrained (Millions)	Total Average Annual Benefits Constrained (Millions)	Average Annual Costs 1/ (Millions)	Net Benefits Unconstrained (Millions)	Net Benefits Constrained (Millions)	Benefit-Cost Ratio Unconstrained	Benefit-Cost Ratio Constrained
1	17.40	15.30	15.3	2.10	0.00	1.14	1.00
2	17.57	15.48	19.9	-2.33	-4.42	0.88	0.78
3	17.53	15.44	17.3	0.23	-1.86	1.01	0.89
4	17.63	15.53	23.1	-5.47	-7.57	0.76	0.67
5	15.91	13.95	8.8	7.11	5.15	1.80	1.59
6	15.99	14.04	13.6	2.39	0.44	1.18	1.03
7	15.95	14.00	11.1	4.85	2.90	1.44	1.26
8	16.05	14.09	16.4	-0.35	-2.31	0.98	0.86
9	15.83	13.74	5.7	10.13	8.04	2.78	2.41
10	12.30	10.64	4.9	7.40	5.74	2.51	2.17
11	14.85	13.03	3.8	11.05	9.23	3.91	3.43
12	11.55	10.46	4.9	6.65	5.56	2.36	2 13
13	15.98	13.89	7.4	8.58	6.49	2.16	1.88
14	12.45	10.79	6.6	5.85	4.19	1.89	1.63
15	15.00	13.18	5.5	9.50	7.68	2.73	2.40
16	11.70	10.61	6.6	5.10	4.01	1.77	1.61

1/ Average annual costs are the sum of Federal and non-Federal project costs.

B9. SENSITIVITY TESTS FOR CONSIDERED PLANS OF IMPROVEMENT

Additional investigations directed towards the potential change in benefits attributed to various plans of improvement as a result of changes in study parameters were performed. Changes in two major study parameters, raw material flows and future fleet mix, were investigated to determine the economic stability of the proposed improvements.

B9.1 Changes in Traffic Forecasts

If future upriver raw material requirements do not increase beyond the level forecasted for 1995, several plans will lack economic feasibility. Benefits for Plans 2, 3, 4, and 8 fall below the annual costs of constructing these improvements while benefits for Plans 1 and 6 are only slightly greater than annual costs. In general, all direct delivery and partial transshipment plans are uneconomical if only upriver iron ore benefits are considered. The dependency of these plans upon the total of the upriver, lakefront, and shipyards benefits can be seen in Table B49.

Lakefront transshipment is the only transportation concept that is economically feasible if only the upriver iron ore receipts are considered in the analysis. This is a result of the relatively low first costs attributed to the lakefront plans and the incremental investments and operating costs which would be incurred as iron ore tonnage increases over the planning period. This is in contrast to the direct delivery and partial transshipment plans which require a larger portion of project costs to be incurred prior to the realization of the benefit stream and that only a small portion of the remaining costs are variable with the tonnage throughput.

Lakefront transshipment plans are therefore more economically stable than other plans which require a larger investment of money and an increasing raw material throughput to maintain their feasibility. The impact of a no-growth scenario for lakefront alternatives based upon upriver only is shown in Table B50.

B9.2 Changes in Fleet Mix

The impact of a changed fleet mix on project benefits was evaluated by arbitrarily constraining the future level of tonnage to be shipped in maximum size design vessels in the future. Benefit calculations shown in Tables B36 to B41 assume that future fleets moving iron ore upriver consist entirely of Class 10 vessels operating at a safe system draft of 25.5 LWD. If the availability of Class 10 vessels becomes restricted such that smaller self-unloading vessels will be required to move a portion of the required raw materials to the upriver docks, annual transportation costs will increase and annual economic benefits will decrease significantly. Fleet forecasts therefore constitute a significant study variable which can alter the economic feasibility of most plans of improvement.

Lakefront transshipment alternatives are the most stable of all alternatives considered to possible changes in future fleets. This is primarily a result

of the relatively low annual costs of implementation of these plans. A summary of the fleet change impacts on estimated transportation savings over base case conditions is included in Table B51.

Lakefront transshipment with an upriver conveyor is therefore determined to be the most stable of all lakefront transshipment concepts. This plan is most likely to remain economically feasible if tonnage forecasts failed to reach expected levels or if substantial changes in vessel availability were encountered. Therefore, lakefront transshipment as a transportation concept should be recommended for further study in the Final Feasibility Report.

Table B49 - No Growth Scenario for Upriver Ore Receipts
Lorain Harbor, OH

Alternative Number	Upriver Ore Benefits	All Other Benefits 1/	Total Benefits	Average Annual Costs	Net Benefits	B/C Ratio	B/C Ratio Upriver Ore Only
1	7,949.6	7,353.8	15,303.4	15,300.0	3.4	1.00	0.52
2	7,949.6	7,531.0	15,480.6	19,900.0	-4,419.4	0.78	0.40
3	7,949.6	7,492.5	15,442.1	17,300.0	-1,857.9	0.89	0.46
4	7,949.6	7,584.3	15,533.9	23,100.0	-7,566.1	0.67	0.34
5	6,600.3	7,353.8	13,954.1	8,800.0	5,154.1	1.56	0.75
6	6,600.3	7,435.9	14,036.2	13,600.0	436.2	1.03	0.49
7	6,600.3	7,397.3	13,997.6	11,100.0	2,897.6	1.26	0.59
8	6,600.3	7,489.2	14,089.5	16,400.0	-2,300.5	0.86	0.40
9	6,537.5	7,205.0	13,742.5	5,700.0	8,042.5	2.41	1.15
10	3,435.4	7,205.0	10,640.4	4,900.0	5,740.4	2.17	0.70
11	5,821.6	7,205.0	13,026.6	3,800.0	9,226.6	3.43	1.53
12	3,251.3	7,205.0	10,456.3	4,900.0	5,556.3	2.13	0.66
13	6,537.5	7,353.8	13,891.3	7,400.0	6,491.3	1.68	0.88
14	3,435.4	7,353.8	10,789.2	6,600.0	4,189.2	1.63	0.52
15	5,821.6	7,353.8	13,175.4	5,500.0	7,675.4	2.40	1.06
16	3,251.3	7,353.8	10,605.1	6,600.0	4,005.1	1.61	0.49

1/ Subtotal of annual savings expected to accrue to American Shipbuilding Drydocks and existing Outer Harbor transshipment terminal operated by Republic Steel Corporation.

Table B50 - Impact of No Growth Scenario for Lakefront Alternatives 2/
Lorain Harbor, OH

Alternative Number	Average Annual Transportation Benefits 1/ ($000)	Average Annual Costs ($000)	Net Benefits ($000)	B/C Ratio
9	6,537.5	5,700	837.5	1.15
10	3,435.4	4,900	-1,464.5	0.70
11	5,821.6	3,800	2,021.6	1.53
12	3,251.3	4,900	-1,648.7	0.66

1/ Includes transportation rate savings only for upriver iron ore receipts.
2/ Lakefront transshipment without new channel through Riverside Park.

Table B51 - Fleet Sensitivity Impacts
Lorain Harbor, OH

Transportation Concept	Savings Over Base Case: Scenario 1 ($)	Scenario 2 ($)	Scenario 3 ($)
Direct Delivery	10,042.2	5,316.8	2,657.8
Partial Transshipment	8,556.8	5,597.3	2,796.7
Lakefront Transshipment			
Alternatives 9 and 13	8,627.8	3,525.5	655.5
Alternatives 10 and 14	5,097.7	74.4	-2,795.6
Alternatives 11 and 15	7,647.9	2,545.1	-324.6
Alternatives 12 and 16	4,342.6	-759.5	-3,629.5

Scenario 1 - Class 10 vessels move all of the forecasted upriver traffic.
Scenario 2 - Class 10 vessels move a maximum of 2,800,000 net tons/year and balance of traffic consists of Class 7.
Scenario 3 - Class 10 vessels move a maximum of 1,400,000 net tons/year and balance of traffic consists of Class 7.

B10. EVALUATION OF VESSEL CONGESTION ON THE BLACK RIVER

B10.1 Introduction and Overview

An evaluation of potential delays that could occur between vessels unloading at the Republic dock and other vessels navigating the Black River has been initiated as a result of the public concerns expressed at a February 1981 navigation workshop in Lorain, OH. A generalized simulation model was subsequently developed with the assistance of North Central Division - ADP. This program incorporates a number of variables to analyze the potential interaction of Great Lakes vessels. Distributions of vessel sizes, duration of the unloading cycle and required transit times for vessels on the Black River which will move the forecasted volumes of iron ore and limestone to the upriver docks in conjunction with fleet and tonnage statistics at the lakefront dock constituted the principal congestion model inputs. Other users of the Federal channel were not included in this preliminary analysis of potential congestion problems for the Black River.

Delays are defined as the interaction between Class VII (Seaway) and Class X vessels at the mouth of the Black River. Class VII vessel sizes have been designated as the maximum size vessel which can navigate the Black River channel under existing conditions. Smaller vessels (i.e., sand dredges, petroleum tankers, and barges and bulk freighters less than 730 X 75 feet) are not expected to incur delays as they navigate past vessels docked at the Republic facility and are not included in this preliminary analysis. A vessel delay event (VDE) occurs whenever a Class VII vessel, moving up or down river, attempts to navigate past a larger vessel unloading at the lakefront dock on the west bank of the Black River. The number of these occurrences during any selected 30-day period within a 9-month navigation season can be calculated by the computer program. Program outputs can be subsequently cumulated to reflect a full navigation season.

Class X vessels can be delayed up to a maximum of 3 hours per VDE. This is an estimate of the time interval required to maneuver a large vessel away from the Republic dock into the Outer Harbor, into the coal slip, and back to the original point of unloading. Duration of these activities was obtained from local dock operators, vessel masters, and representatives of both steel companies. A decision rule has been incorporated into the program to allow for completion of an unloading cycle at the lakefront dock whenever it would require less time than maneuvering the larger vessel into the coal slip. This realistically represents the least cost alternative for both vessels since any other combination of vessel delays would produce a higher level of economic losses. In this case, a delay penalty up to 3 hours would be charged against the smaller vessel only. In general, hourly operating costs for these vessels is much lower than 1,000 X 105-foot self-unloading sizes.

Two types of delays have been included in the analysis. Whenever a Class X vessel has less than 30,000 tons to unload (i.e., less than 3 hours duration at 10,000 TPH unloading speed), the Class VII vessel will incur a maximum delay of 3 hours. Otherwise, each vessel is partially delayed while the larger vessel maneuvers away from the dock into the coal slip. One-half of the total delay penalty is charged against the smaller vessel (1.5 hours)

while it waits for a clear approach into/out of the Outer Harbor. This vessel response pattern would result in a total delay penalty of 3 hours would be charged against the larger vessel. Total delays per event can therefore be a maximum of 4.5 hours per VDE. However, the random arrival of both sizes of vessels at both dock locations interact to produce delay values that may be less than the maximum value. These estimated delays are cumulated into two summary statistics for each type of vessel at each location: number of vessels penalized at each dock and hours of delay associated with the selected monthly level of tonnage activity activity at each dock.

Forecasted tonnages for each dock at several points in the future (1995, 2000, 2010,...2045) were distributed throughout the 9-month navigation season based upon historical seasonal percentages for U. S. Steel Corporation between 1976 and 1979. This distribution reflects the seasonal depletion of raw material inventories and the accumulation of pre-winter ore and limestone stockpiles. Levels of vessel activity for intermediate months were estimated as either building up to or declining from these seasonal peaks. Each steel company was assumed to follow a similar raw material handling pattern. Although this parallel scheduling activity is unlikely to prevail throughout the future, it provides the upper limit on estimated delays and economic losses which might prevail in the future. These delays and costs could be avoided by implementation of the Riverside Park channel cut. All estimates of delay, future traffic, and computer program assumptions will be further refined and displayed in the Final Feasibility Report (Stage 3 Report).

B10.2 Conclusions

Total vessel hours of delay were converted to economic and financial losses by use of vessel hourly operating costs summarized in Table B32A. These vessel costs are based upon specific assumptions as to length of season, length of vessel, daily operating costs, etc. A review of the text of Appendix B will provide an overview of the cost structure for the relevant vessel sizes. Future levels of vessel delays and associated costs have been converted to an equivalent average annual value of $473,900 based upon a 50-year project evaluation period and 7-3/8 percent project interest rate. A summary of the changes in vessel delays during the project planning period is shown in Table B52.

Table B52 - Future Vessel Delays on the Black River
Lorain Harbor, OH

	1995	2000	2010	2020	2030	2040	2045
Lakefront Tonnage	6,500,000	6,500,000	6,500,000	6,500,000	6,500,000	6,500,000	6,500,000
Upriver Tonnage 1/	5,854,000	6,373,000	7,545,000	8,929,000	10,569,000	11,200,000	11,200,000
Class 10 Vessel Delays (hrs)	63.7	74.3	116.8	154.0	215.6	228.2	228.2
Class 7 Vessel Delays (hrs)	101.4	116.1	173.1	223.4	306.6	324.0	324.0
Total Vessel Delays (hrs)	165.1	190.4	289.9	377.4	522.2	552.2	552.2
Financial Costs of Delays ($) 2/	284,600	328,900	503,600	657,000	911,000	963,900	963,900

1/ Includes limestone tonnage estimated at 40 percent of future iron ore traffic.
2/ Class 10 hourly costs of $2,195 and Class 7 hourly costs of $1,428 based upon 270-day navigation season and a 50-year vessel life cycle.

PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS
ON
LORAIN HARBOR
OHIO

APPENDIX C
CULTURAL RESOURCES

APPENDIX C

INVENTORY OF CULTURAL RESOURCES

DIKED DISPOSAL SITE NO. 7
LORAIN HARBOR, OHIO

CONTRACT NO. DACW49-75-C-0063

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS

GAI CONSULTANTS, INC.
MONROEVILLE, PENNSYLVANIA 15146

APPENDIX C
CULTURAL RESOURCES

The report contained in this appendix presents the results of a cultural resources survey performed in the project area in 1974. This survey was performed as part of the Diked Disposal Site No.7 Project, Lorain, Ohio. This report also represents an assessment of the project area for the Lorain Harbor Commercial Navigation Preliminary Feasibility Report, as the impact areas for both projects coincide. While the specific impact predictions contained in this report pertain only to the dike disposal site (impact predictions for the Lorain Harbor Commercial Navigation Preliminary Feasibility Report are contained in the main report), the site location data and historical overview apply to the Lorain Harbor Commercial Navigation Preliminary Feasibility Report as well.

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SCOPE OF CULTURAL RESOURCES RESEARCH

The purpose of this research effort by the Buffalo District, Corps of Engineers was to compile an inventory of all resources of cultural value or importance within or adjacent to the land and water areas of proposed Site No. 7 Diked Disposal Area in Lorain Harbor, Ohio. The research consisted of a literature search and field surveys to determine the presence or absence of cultural resources by which the project area has been fashioned or which may be affected adversely, damaged, or destroyed by the proposed project. Figure 1 is an overview of the general project area, while Figure 2 is a plan view of moored dredge and discharge pipeline locations by which the proposed project work would be implemented. The potential impact of the diked disposal area on the existing cultural resources was considered to be of prime importance; however, a broader area adjacent to the main project area was also taken into consideration as a means of placing the potential impact on all of the cultural resources into a sufficiently broad perspective to allow for an objective evaluation.

The field survey of the project zone and adjacent areas in the harbor and along Black River was undertaken by Dr. Don W. Dragoo, Curator of Anthropology, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania during the week of June 16-20, 1975. The immediate project zone was observed

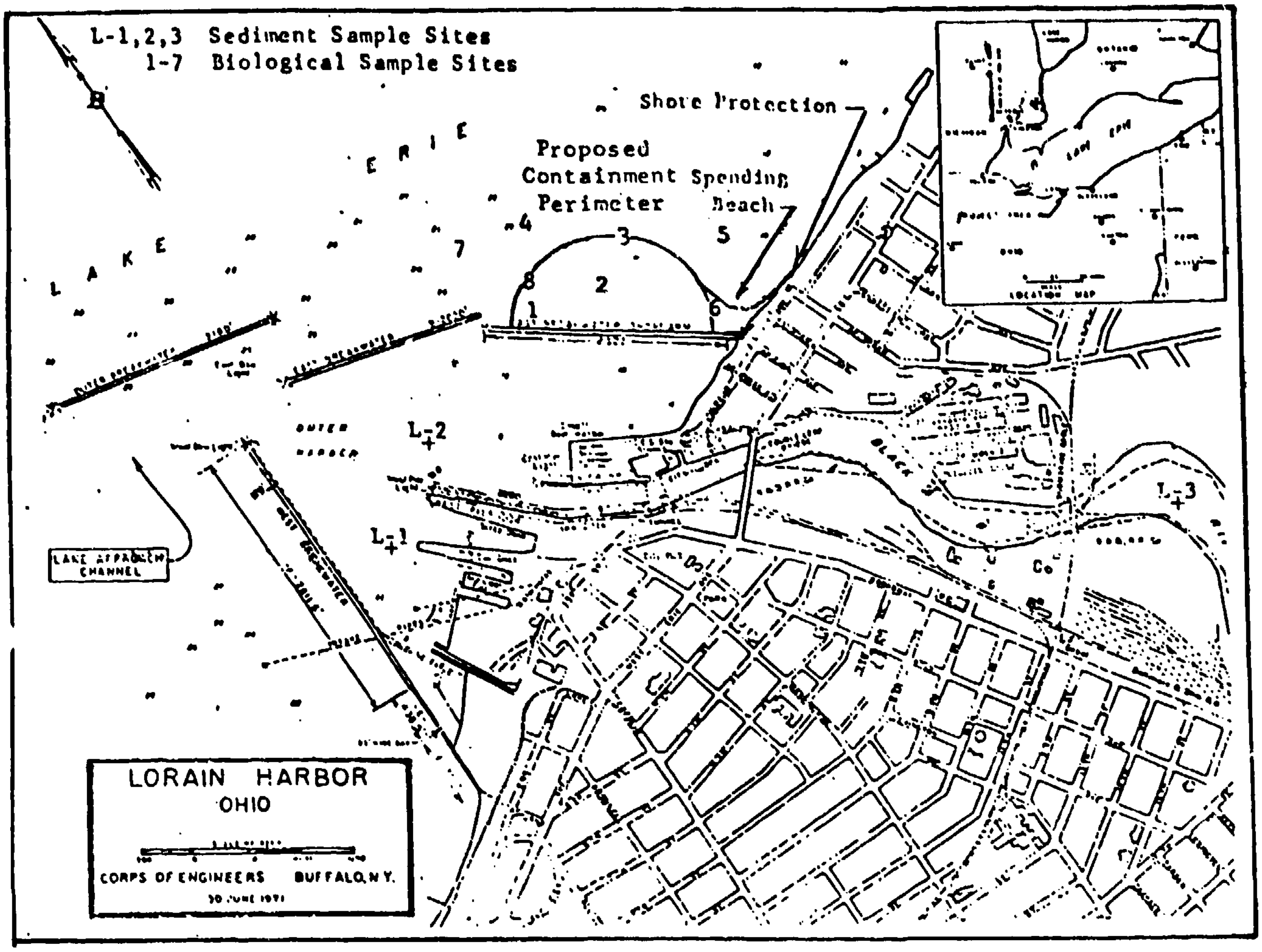


Figure 1. Project Location

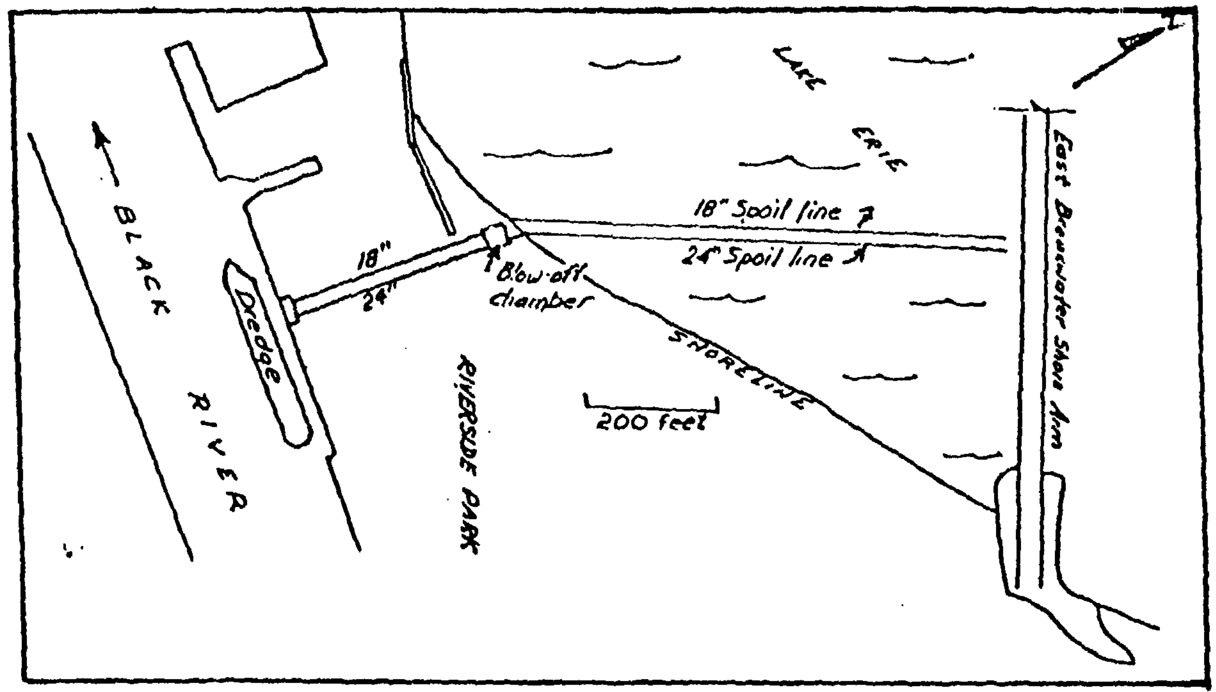


Figure 2. Plan View Showing Location of Moored Dredge and Discharge Pipelines.

for the remains of any significant archaeological or cultural features mentioned in the literature and a field search was made for any additional sites that could have escaped mention or previous recording. It was determined by both records and direct observations that the water areas of the harbor adjacent to the project have been extensively modified and disturbed by dredging and the construction of breakwaters. No remains of historical significance that would qualify for inclusion on the Historical Register are known to be present in the water areas in or surrounding the project zone. Although scattered debris of shipping activities and the remains of a wreck are known to be present, salvage of these items would not warrant the high cost of recovery as they are of minor historic value and similar or like items are still in existence or present in museums such as the Great Lakes Historical Museum at Vermilion, Ohio. A magnetometer survey could probably locate some items on the floor of the harbor, but it would be exceedingly difficult to justify on historical or cultural grounds the high cost of such a survey, or the underwater salvage of the material once it is accurately located.

During the field survey, all land areas and the shoreline discussed in this report were carefully checked and observed for any evidence of the archaeological and historic sites known to have been present according to the historic

records and literature. Intervening areas were also field checked for possible remains (particularly prehistoric) not recorded in the literature. Land around Lorain Harbor has been subjected to extensive modifications and disturbances in recent times, and most of the areas known to have been the location of archaeological or historic cultural resources are now covered by present-day buildings, streets, railroads, docks, and factories which preclude the direct observation of the underlying soils. However, in such cases, it is probable that all earlier remains were destroyed during the construction of the foundations for these features since the remains of the earlier structures were on or immediately below the surface. Of all the areas mentioned in this report, only a small portion of Riverside Park appears to be open land. Surface observation and soil checks of this area indicated that there had been recent soil disturbances and no evidence for prehistoric or early historic features or cultural debris was found. Industrial waste such as slag cinders from the steel mills is to be found scattered over much of the area along the Black River where it has been used for fill in the railroad yards of the Baltimore and Ohio Railroad. Dredging has modified and altered the natural configuration of the banks of the Black River throughout the project area. Retaining walls and riprap cover large sections of the river bank.

CULTURAL RFSOURCES

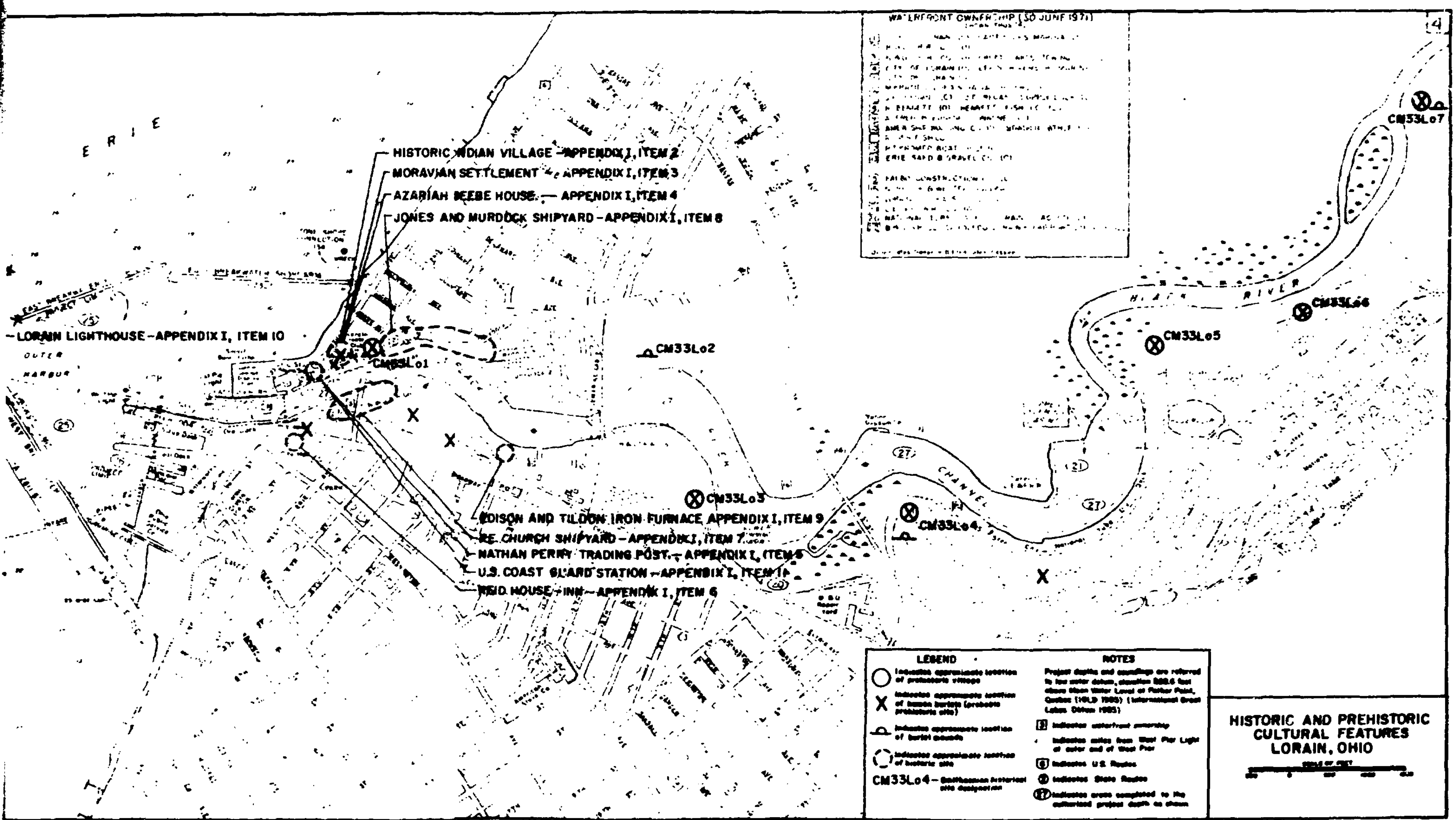
This inventory was compiled from a comprehensive review of existing archaeological and historical literature and records of the city of Lorain and Lorain County in the Lorain County Historical Society, Elyria Public Library, Ohio State Historical Society, and Carnegie Museum of Natural History Library (Pittsburgh, Pennsylvania). Co-ordination of pertinent material research was conducted through the staffs of these institutions and the U. S. Coast Guard Station, Lorain, Ohio. The current status of all potentially identifiable cultural resources was field checked to confirm the literature research. The accounts of cultural resources known to have existed or which have been found to be still present are listed chronologically within their respective categories.

Prehistoric

The prehistoric cultural resources of the lower Black River and the Lorain Harbor area are not widely known because of the lack of scientific research conducted in the Lorain area in recent times. A summary of Lorain County prehistoric archaeology was published by Colonel Raymond C. Vietzen in 1967 (Ref. 6). According to Vietzen's report, considered to be an authentic account, the earliest prehistoric occupation of the Black River area dates from about

7000 B.C. with the presence of Archaic cultures. Earlier Paleo-Indian remains appear to be absent, or at least unknown, in the area immediately adjacent to Lake Erie and the project area. From 7000 B.C., there appears to have been continuous occupation of the Lorain County area and the Black River drainage basin by various American Indian cultural groups including various Archaic peoples 7000-1000 B.C., the Adena 1000 B.C.-A.D. 100, Hopewell 100 B.C.-A.D. 600, and Late Woodland and Late Prehistoric A.D. 600-1650. The last Indian group believed to have occupied the area in prehistoric times was the Erie, but other contemporary groups may have also been living in the area. Current knowledge of the Late Prehistoric cultures of northern Ohio indicates that the setting was very complex, probably involving several groups. One of these may have been the Erie which supposedly were destroyed by the Iroquoian peoples living to the east in present-day New York State.

The most important reference to prehistoric sites in the lower Black River and Lorain Harbor area is found in a map on file at the Lorain County Historical Society, Elyria, Ohio. Attributed to P. Bungart, this map shows the location of archaeological sites known to have been present prior to or about 1897. Approximate locations of those sites nearest the present project are shown on Figure 3. Six villages and three burial mounds are shown. The burial mounds undoubtedly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CM33Lo5
CM33Lo6
CM33Lo7
ERIE
OUTER HARBOR
BLACK RIVER
CHANNEL
WATERFRONT OWNERSHIP (30 JUNE 1971)
ERIE SAND & GRAVEL CO.
LEGEND
NOTES
CM33Lo4 -
HISTORIC AND PREHISTORIC
CULTURAL FEATURES
LORAIN, OHIO

FIGURE 3

belonged to the Adena and Hopewell cultures of 1000 B.C.-A.D. 600 (Ref. 2, pp. 1-315). Village sites adjacent to the mounds probably belonged to the same cultures, but later occupations may have also been present on the same areas. Most of the village sites can be attributed to later groups of the Late Prehistoric Period (A.D. 1000-1650). Some objects and a human skeleton on display at the Lorain County Historical Society appear to belong to the Late Prehistoric Period.

Several places on the Bungart map are marked as areas where human burials were found. Such recognizable human skeletal remains are generally associated with Late Prehistoric village sites when they are found in flat areas unassociated with burial mounds. Thus, it appears likely that prehistoric villages, or possibly early historic Indian settlements, were also present in these areas.

All sites shown on the Bungart map were within the present-day Lorain city limits. Village CM 33 Lo 1 was partially situated within the area (marked as Riverside Park on Figure 2) of the proposed pumpout pipeline from the dredge to the disposal area. A surface survey of this area, however, produced no evidence that any significant portions of this village remain intact. Recent disturbances in the area by construction of streets, buildings, and other urban infrastructure has modified the area since prehistoric times

to the extent that the site is not visible today. In view of the fact that some remains of this village may have escaped detection or destruction, it is important that work crews be cautioned to watch for buried cultural debris and human bones during construction of the pipeline for spoil across this area. In the event that such items are uncovered, observation and salvage by a competent archaeologist could be a means of preserving the remains.

All of the other sites shown on Figure 3 appear to have been destroyed since the river banks and immediately adjacent lands have been thoroughly disturbed throughout the lower portion of the Black River. All of the remaining site areas on the Bungart map are now covered by industrial plants, roads, railroads, or storage areas for raw materials. No trace of any of the marked sites could be found during the field survey, and it is unlikely that any significant portions of them remain intact.

It is our considered judgment, therefore, that no important prehistoric sites will be adversely affected by constructing the proposed Site No. 7 Diked Disposal Area. As indicated, the only possible surviving remains would be those of site CM 33 Lo 1 in the Riverside Park area, and if such remains are detected, a program of immediate, limited salvage would be warranted to recover and study such remains. Since the greater portion of the site evidently has already

been destroyed, and it is unlikely that extensive knowledge will ever be gained of the site's total configuration and cultural importance, the site would not meet the criteria for inclusion on the National Register.

Additional information of some research value pertaining to the prehistory of the Black River area is contained in the following publications. The work described in these reports was done many years ago, and it is suggested that the conclusions drawn therein may not always conform to more recent ideas concerning the prehistory of northern Ohio.

Brinton, Daniel Garrison

1884 On the cuspidiform petroglyphs, or so-called birdtrack rock sculptures of Ohio. Philadelphia Academy of Natural Sciences, Proceedings, 1884, Vol. 36, pp. 275-277.

Galbraith, John H.

1915 Ohio cave dwellers. Ohio State Archaeological and Historical Quarterly, Vol. 26, p. 540.

Greenman, Emerson F.

1935 Seven prehistoric sites in northern Ohio. Ohio State Archaeological and Historical Quarterly, Vol. 44, pp. 220-237.

Newberry, John S.

1874 Ancient earth-works in Lorain County. Geological

Survey of Ohio, Report, II, Pt. 1, pp. 223-224.

Newberry, John S.

1889 Ancient mining in North America. American Antiquarian, Vol. 11, pp. 164-167.

Vietzen, Raymond C.

1946 Prehistory of the Black River Valley. Ohio Indian Relic Collectors Society, Bulletin, Vol. 15, pp. 6-9.

Wittlesey, Charles

1850 Notice of two ancient skulls and other bones found in a cave near Elyria, Lorain, Ohio. American Association for the Advancement of Science, Proceedings, Vol. 5, pp. 16-18.

1875 The rock inscriptions, Amherst, Lorain County, Ohio. Scientific Monthly: A Magazine Devoted to the Natural Sciences, Vol. I, No. 2, pp. 55-58.

Early Historic Indian Cultural Resources

When European settlers arrived in the Black River area near present-day Lorain, Ohio, the land was claimed by the Seneca Indians, the major western tribe of the Iroquois, whose traditional homeland was in present-day western New York state. During the latter half of the 17th century, the Iroquoian peoples spread westward around the southern shore of Lake Erie and across northern Ohio, eliminating the Erie

and other groups of northern Ohio who had claimed this territory throughout the preceding Late Prehistoric Period (A.D. 1000-1650). Archaeological evidence does not indicate that the Iroquoian peoples established major villages in northern Ohio during the late 1600's and most of the 1700's, but they did establish small settlements and camps that enabled them to control the area for hunting and participation in the fur trade.

The 1700's were a period of great stress for all of the Eastern Indian tribes. Colonial settlements of their homelands forced many of these tribes, such as the Delaware and splintered groups from other tribes, to resettle across the Allegheny Mountains in the Upper Ohio Valley by the early 1700's. By the mid-1750's, the struggle between France and Britain for the Upper Ohio River country again forced the Indian to seek new homes farther West in Ohio. Among the groups who entered northern Ohio and contested for living space with the Iroquois (mostly Senecas) were the Delaware, Wyandots, Hurons, and Shawnees.

The first documented evidence of the presence of these people in the Black River area is found in the story of Colonel James Smith who was captured by the Indians in 1755 while cutting a wagon road through the Allegheny Mountains in Pennsylvania. The Indians took Smith to a French fort and then moved on to the Black River area where they settled

for a time. Smith was adopted by the tribe, but later escaped and joined the regular British Army.

The first European to visit the Lorain area, however, may have been a Frenchman named Louis Vagard. A stone in the shape of an Indian idol with the inscription: "Louis Vagard, La France, 1533" was found by a farmer in southern Lorain County, but the authenticity of this stone may be questioned (Ref. 4, p. 89). Other French and English traders undoubtedly visited the area, but history has not recorded their passing.

Archaeological evidence of the historic Indian groups living in the Black River area of Lorain County is practically nonexistent according to Colonel Raymond C. Vietzen, a long-time resident and student of the area's prehistory and early history (Ref. 4, p. 7). The archaeological field survey conducted as part of this project confirmed the apparent lack of evidence of historic Indian remains in Lorain as stated by Vietzen.

Early Historic Settlement of Black River and Lorain, Ohio

The area of Lorain County was originally encompassed in a land grant made to the Connecticut Colony by the British consisting of a narrow corridor of land about seventy-five miles wide and extending from ocean to ocean. The French claims to this area were eliminated at the end of the French

and Indian War (1754-63). In 1786, Connecticut gave up its claims to this vast tract of land to the Federal government, but in so doing, reserved for the citizens of Connecticut a strip of land extending 120 miles westward from the Pennsylvania boundary and about fifty miles southward from the southern shore of Lake Erie. Known as Connecticut's Western Reserve, the land was sold to settlers through the Connecticut Land Company with the exception of the westernmost 25 miles (now Huron County) which was set aside for the citizens of Connecticut shore towns who had suffered fire and other damages at the hands of the British forces during the Revolutionary War. Many of these people from New England were soon to become the main occupants of Lorain County and were to play an important part in the future development of northern Ohio (Ref. 5).

The earliest attempted permanent settlement in Lorain County was made at the mouth of the Black River in 1787. In April of that year, a group of Moravians under the leadership of their minister, David Zeisberger, moved with several Christian Indians of the Delaware tribe from a campsite on the Cuyahoga River to the mouth of the Black River. They began the task of building a permanent settlement there, but their hopes were soon dashed. A few days after they had set to work building cabins, a message from the chief of the Delawares, living then in that part of Ohio, ordered the new

settlers to leave the Black River area. The new settlement was abandoned, and the Moravians moved westward to the Sandusky River region (Ref. 1, p. 330-333). Little evidence of this first, short-lived settlement has survived. It is now impossible to precisely locate the site of this village, but available information suggests that it was near the present-day Riverside Park.

After the unsuccessful Moravian settlement, it was 1807 before settlers again arrived to claim this land. In the meantime, the Indians had relinquished their claims to the area by the treaty of Fort Industry in 1805. The first family to settle in Black River (later to be changed to Charleston and then Lorain) was that of Azariah Beebe, who came from Vermont in 1807. Beebe built his log cabin on the east bank at the mouth of the Black River and sent word for his wife and employer's son, Nathan Perry, Jr., to join him. Nathan Perry, Sr., soon built a trading post on the east bank of the Black River in the same area now occupied by the U. S. Coast Guard Station and traded with the various Indian tribes during the next three years after which time the Indians began to move westward (Ref. 1, p. 330-331).

By 1810, Nathan Perry, Sr., and the Beebes had left the area and Daniel Perry, an uncle of Nathan, moved into the house built by the Beebes. Other families began to move into the area that same year, and the small trading post

settlement began to grow. Among the new arrivals were Jacob Shupe, Joseph Quigley, George and Andrew Kelso, Ralph Lyon, and a Mr. Seely. In 1811, John S. Reid, Quartus and Aretus Gilmore, and William Martin joined the residents.

John S. Reid was a carpenter by trade, and with the help of other members of the settlement, constructed a large blockhouse in 1812 on the corner of what is now Broadway and First Street in Lorain. This blockhouse served as the Reid home, tavern and inn, post office, and office for the justice of the peace. Reid was named the first postmaster and justice of the peace and held these positions from 1812 to 1827. James Reid and later his son, Conrad, were to dominate the political life of this area for many years.

Over the next several years, the settlement grew slowly but steadily. It was not, however, until July 16, 1834 that a map presented to the county recorder to file for public record marked the settlement's emergence as a corporate town. A notation on the map stated: "A town plat at the mouth of Black River in the township of Black River in Lorain County and the State of Ohio: scale, 250 chains to the inch. Survey May 10, 1834. Commencing at a stone planted at the north corner of public square from which plat is surveyed." It was not until two years later that the town council chose the name Charleston in the hope it would attract new settlers and Eastern railroad and canal promoters.

Unfortunately, the change of name failed to attract many new settlers, and the hoped for railroad and canal did not materialize. The Ohio legislature had granted a franchise to a group of railroad promoters in 1834 to build and operate a railroad from Painesville to Sandusky which would have passed through the Charleston townsite. However, the state-subsidized promoters, known as the Ohio Railroad Company, collapsed, costing Ohio $249,000 and Charleston its link with Ohio commerce. The town was destined to slumber until the railroad finally arrived in 1872 (Ref. 7, pp. 288-291 and Ref. 4, pp. 88-92).

Apparently, none of the structures associated with the early settlement have survived. More recent construction around the mouth of the Black River has presumably erased all traces of the pioneer cabins and the Reid blockhouse. It is concluded that construction at the proposed Site No. 7 Diked Disposal Area will in no way further disrupt any remains of these early structures.

Early Commerce and Industry - 1807-1872

With the removal of the Indians from northern Ohio, the trading post at the mouth of the Black River turned to serving the settlers that slowly had begun to arrive in the area. The industrial life of Black River did not begin for another ten years until the area around its mouth became the

focus for boat and shipbuilding. The first vessel constructed was the General Huntington launched by F. E. Church in 1819 at a shipyard on the west bank of the Black River, just opposite the present-day location of the American Shipbuilding Company. In 1820, Augustus Jones and William Murdock, who had been shipbuilders on the Connecticut River, received land grants on the east bank near the mouth of the Black River and began building sailing vessels with shipbuilders from the east who had been put out of work there during the War of 1812 when the British destroyed the Connecticut shipyards. The first ship launched at the Jones and Murdock shipyard was the sloop William Tell in 1828.

Shipyards were soon established along both the east and west banks of the Black River and also along the lake shore. The village of Black River was well suited for shipbuilding, since the river afforded a good harbor and fine timber was present in the forest surrounding the village and lining the shores of the Black River. Many of the early shipbuilders became ship owners, and fleets of schooners sailed in and out of the Black River carrying the commerce from the area, which consisted mainly of grain from the rich farm lands of Lorain County.

The era of wooden shipbuilding continued at the mouth of the Black River until 1873. One hundred and twenty-three major vessels as well as about forty scows were constructed

during this period. The list of these major vessels is given in Appendix II of this report.

The building of the first steamboats, Bunker Hill and Constellation in 1837, led to the formation of the Black River Steamboat Association. When the Bunker Hill was launched from the J. N. Jones Shipyard, it was necessary to tow it to Cleveland in order to equip it with the boiler and fittings. The Constellation was completed at Black River by hauling the steam machinery by oxen from Pittsburgh. These first ships had been constructed under the controlling interest of parties in Buffalo and Cleveland; but the formation of the Black River Steamboat Association enabled the local businessmen to control the building of future craft. In 1838, the Association launched its first vessel, the Lexington.

From its inception in 1819, shipbuilding was to remain Black River's major industry until the coming of the railroad in 1872. The population of Black River expanded very slowly throughout the period, and the ship workers often left the area during the summer as the community was infested with malaria and typhoid during these hot months. The village lacked public sanitation, and the undrained marshland along the river was a breeding ground for mosquitoes. After 1853, many of the farmers who had previously hauled their products to the mouth of the Black River for shipment

by boat, now took their grain to the railroad in Elyria.

After shipbuilding, the only other notable industry in Black River was fishing. The waters of Lake Erie off the mouth of the Black River were especially noted for perch, pike, herring, pickerel, whitefish, and lake trout. Fishing had been important in the area from the beginning of the settlement, but it did not assume substantial proportions in the economy of Black River until the late 1860's and early 1870's.

The first iron furnace in the Black River settlement was erected in 1860 on the west bank of the river at what is now the foot of Eighth Street. The owners of the furnace were S. O. Edison and Dr. Philo Tilden, while William McKinley, father of the President, was furnaceman and bookkeeper for the company. The company operated in Black River until 1871 when the plant burned to the ground. It was never rebuilt, and Edison moved his operation to Saginaw Bay, Michigan, where it became known as S. O. Edison & Company. The location of the Black River furnace was later occupied by the Ranney Fish Company.

The iron furnace had been one of the few bright spots in the economy of Black River (Charleston) during the 1860's. With its destruction by fire in 1871, the earlier loss of the grain trade to the railroads at Elyria, and the decline of the wooden shipbuilding industry, Black River entered the

1870's in a state of economic uncertainty. Many of the merchants had departed, the warehouses were parcelled out among the local farmers for barns and fences, the hotels were empty, and the corporate organization was abandoned. Black River, or Charleston, was a town in name only.

The field survey for the locations of the above mentioned cultural features of the 1807-1872 period indicates that there are obviously no significant remains of these historical resources intact today. All have been obliterated over the years by more recent construction and activities at and around the mouth of the Black River. There is now no evidence of the early shipyards that once spread along the lake front east of the mouth of the Black River in the area to be occupied by the proposed Site No. 7 Diked Disposal Area. Decay and the wave action of Lake Erie have destroyed the old launch ramps, and stone and concrete riprap presently face the shore line in an effort to stem further erosion.

Sources for the above information and additional details may be found in the following items:

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262. The Lewis Publishing Company, Chicago.

Metcalf, George P.

1967 Lorain County, Ohio - A short history. Pathways of the Pioneers, Vol. 2, No. 2, Lorain County Historical Society, Elyria, Ohio.

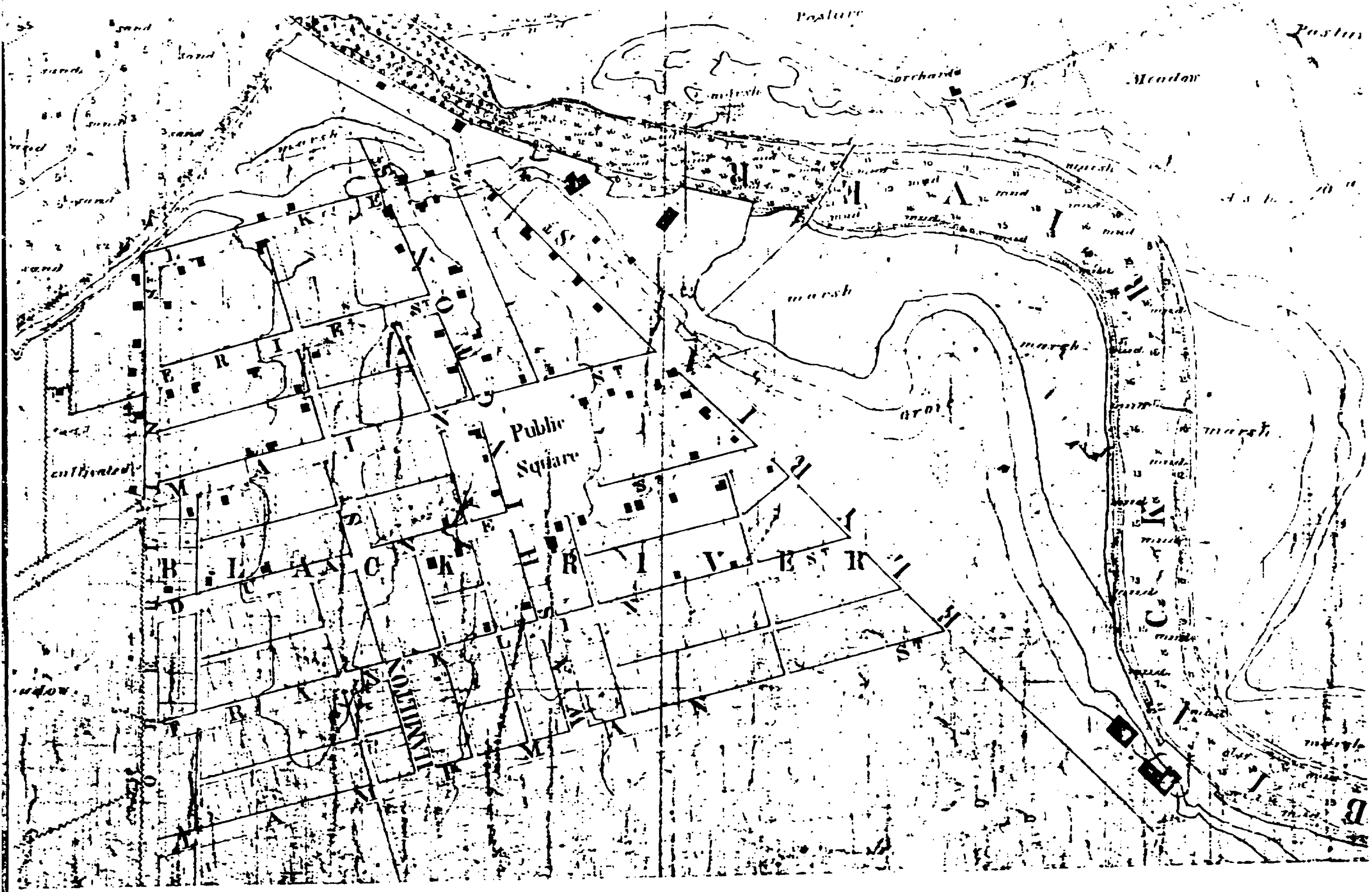
Wright, G. Frederick

1916 A standard history of Lorain County, Ohio, Vol. 1, The Lewis Publishing Co., Chicago.

Lorain County Sesquicentennial 1824-1974, pp. 88-98, American Multi-Service, Elyria, Ohio.

The Development of Modern Lorain, Ohio 1872-1975

Black River (Charleston) was on the verge of becoming a ghost town when several businessmen realized the importance of the Black River harbor as a lake port for the export of coal from southern Ohio. The railroad was opened to Black River (Charleston) in 1872 by the Cleveland, Tuscarawas Valley and Wheeling Railroad, later renamed the Cleveland, Lorain, and Wheeling Railroad and now part of the Baltimore and Ohio Railroad system. At that time, there were less than 500 inhabitants in Black River, and the plat map of the village shows only a few blocks of structures situated on both the east and west side of the river near the harbor (Ref. 3). Figure 4 shows the project vicinity in 1865, which was identical to that shown on the 1872 map.



?ODUCED FROM: MAP OF THE
?OR OF BLACK RIVER, OHIO 22 MAY 1865
?RMY CORPS OF ENGINEERS

400 0 400 800
SCALE 1"=400'

LORAIN, OHIO
1865

The coming of the railroad revived Black River. In 1874, an application was made to the Lorain County commissioners for incorporation as a village under the name of Charleston. The U. S. Post Office Department refused to approve the name, however, because there was another Charleston, Ohio. The name Lorain was then chosen by the town council, and the village was officially incorporated as Lorain, Ohio, in 1876. The population of the village began to grow rapidly, and by 1880, there were 1,595 inhabitants, more than triple the 1870 count. Lorain had finally achieved importance and a stable economic foundation.

Since 1880, the following major events have shaped the growth and development of Lorain into the major industrial city of today. (See Ref. 7 and Ref. 4 for further discussion.)

a. During the late 1870's and early 1880's, John Gawn established the first large-scale commercial fishery. Other companies were formed about 1889 with the partnership of the Kolbe Brothers and Ranney Company followed soon by T. W. Smith, which was later merged with the A. Booth Company. In 1901, the Reger and Warner Company was formed. The commercial fishing activities of these companies were to become the most extensive on Lake Erie. After 1960, commercial fishing on Lake Erie

was greatly reduced because of pollution from lake front cities and industries and the increased population of the lamprey eel which could enter the Great Lakes more readily through the St. Lawrence Seaway, which opened in 1959. Today, perch are the most valuable commercial fish found in the waters off Lorain's harbor.

b. Following the coming of the railroad in 1872, new small industries were established in Lorain. Among these were the planing mills of Brown Brothers and Company and E. Slaight and Sons, and the Lorain Stove Company.

c. In 1881, the Nickel Plate Railroad extended its route through Lorain providing direct access to cities and towns east and west.

d. The Haydenville Brass Works moved from Haydenville, Massachusetts to Lorain in 1881, the town's first basic industry not based on water transportation since the destruction of the iron furnace in 1871. By 1883, the brass factory was the town's largest employer, and the population of the town doubled within a period of sixteen months. The brass factory remained in business until 1903.

e. The most important event in the growth of Lorain was the decision in 1894 to move the Johnson

Company, manufacturers of steel rails for traction lines, from Johnstown, Pennsylvania to Lorain, Ohio. As a condition to this move, the city of Lorain agreed to straighten and dredge the Black River to make it navigable to the Johnson Company plant, which was to occupy a large tract of land south and east of the mouth of the Black River. The Johnson steel mill began operation on April 1, 1895, and Lorain began its emergence as an important steel-producing center. The plant operated as the Johnson Company until the company was reorganized and the name changed to Lorain Steel Company in 1898. With the reorganization came an expansion of manufacturing facilities and improvements in methods. The Lorain Steel Company was soon taken over by the National Tube Company, which in turn became a subsidiary of the newly organized United States Steel Corporation. Since that time, there has been continued expansion and development of the steel-making facilities with over 10,000 people now employed in this industry in Lorain. There can be little doubt that the steel industry was the spark that saved Lorain from obscurity and made it the important industrial center that it is today.

f. With the arrival of the steel industry, there was also a revival of shipbuilding. In 1897, the Cleveland Shipbuilding Company organized and built a shipyard on the east side of the Black River opposite the location of the early shipyard. Here, in 1898, was launched the first steel ship built on the Great Lakes. Christened the Superior City, it was then the largest ship on the Great Lakes. In 1899, the American Shipbuilding Company gained control of the Lorain shipyard and has continued its operation to this day. Ships built here include ore carriers, passenger ships, railroad care ferries, tankers, self-unloaders, tugs, barges, and ocean-going freighters. During both World Wars I and II, many ships were constructed at Lorain. The company has pioneered in the design and construction of the largest and fastest ore carriers on the Great Lakes. After World War II, the Wilfred Sykes built at this yard was known as the "Queen of the Lakes." For the past several years, the American Shipbuilding Company has been constructing giant ore carriers over 850 feet long.

g. Since the arrival of the railroad in 1872, the shipment of coal and other goods from Lorain has

been important in the commerce of the area. The Baltimore and Ohio Railroad has long maintained extensive terminals on the west bank of the Black River and on the lake front. Beginning with the dredging of the river in 1894, there have been continued improvements to the harbor facilities and navigability of the Black River upstream to the steel mills. Although constant improvements had been made to Lorain Harbor by the U. S. Government since 1828, the modern development began with the passage of the River and Harbor Act of June 3, 1996, which authorized the survey of the harbor area at the mouth of Black River. Subsequent acts of 1899, 1907, 1910, 1917, 1930, 1935, 1945, 1960, and 1965 authorized and provided for improvements which included the construction of breakwaters and the dredging of the harbor area and the Black River. The harbor is naturally deep and one of the best in the Great Lakes. A western and an eastern sea wall protects the harbor from storms. Key features are shown on Figure 4. According to records at the U. S. Coast Guard Station at Lorain, the first beacon of record in the harbor was during the Civil War. There probably was an earlier one, but no record exists of it today.

The Lorain Beacon Building was built in 1898, and James Connolly was the light keeper for the U. S. Light House Service. The present light house, built in 1909, along with the Coast Guard Station, represent the oldest extant public structures in the entire city.

From the above listed major structures and events came other benefits to the growth and development of Lorain as a major industrial city. Steel, shipbuilding, and lake commerce have provided a stable economic base for the area since 1894. Attendant to these developments have been a steady growth in population and the establishment of many small businesses, churches, schools, and public facilities necessary to sustain the continued well-being of the population.

DISCUSSION AND CONCLUSIONS

The focus of major economic activity in Lorain has always been the Black River and the lake harbor at its mouth. As new industries came into existence or old industries modernized, earlier structures were destroyed. Obviously, improvements or expansion could not be accomplished in such a restricted area without destruction of these older features. As a result, modern-day Lorain today has little remaining evidence of its days as the struggling village of Black River and Charleston. Present-day Lorain is a city whose rise to prominence has occurred within the past one hundred years, its greatest development having taken place since 1900. Since the arrival of the railroad in 1872, the steel mills in 1894, and the return of the shipyards in 1897, Lorain has become a small industrial giant whose activities have erased the evidence of the lean days prior to 1872.

Two natural disasters have also contributed to the loss of Lorain's links to its past. Following several days of rain in 1913, the Black River turned into a raging torrent, rising fifteen feet above its banks and sweeping ships and structures into Lake Erie. On June 28, 1924, Lorain was hit by a tornado that stands as one of the greatest natural disasters recorded in the Eastern United States. Seventy-eight people were killed and more than 1,000 injured. The

downtown area and the harbor were almost completely devastated. Nearly 200 business places were wrecked, 500 homes completely destroyed, and 1,000 more houses partially destroyed. Much of the downtown area around the mouth of the Black River had to be rebuilt.

In the literature search and field survey conducted as part of this effort, no significant sites, buildings, or features of Lorain's early history or prehistory were found intact around or near the mouth of the Black River. However, the status of those items deemed of prehistoric or historic significance in relation to the proposed Site No. 7 Diked Dredge Disposal Area is indicated in Appendix I.

The only feature of the area adjacent to the proposed disposal area that is considered to be of historic interest and worthy of preservation by the people of Lorain, acting through the Lorain County Historical Society, is the lighthouse in Lorain Harbor. This structure, built in 1909, was scheduled for replacement during the 1960's, but public concern and pressure have so far spared the structure. The fight to save the lighthouse now centers on the problem of financial responsibility for its care and maintenance. Present action in this matter is being undertaken by the Great Lakes Historical Society and Museum of Vermilion, Ohio. The lighthouse has been nominated for inclusion on the National Register of Historic Places, and final action

is pending. (See Appendix III for references concerning the Lighthouse.)

Although the lighthouse is of relatively recent construction and lacks most of the qualifications for inclusion on the National Register, the structure is of historical interest as an example of the period and the growing importance of Lorain as a major Great Lakes port. It, and the companion U. S. Coast Guard Station, are the only structures remaining from the period of Lorain development at the turn of the 20th century. In this respect, the U. S. Coast Guard Station should also be considered culturally integral to the lighthouse. Since the former is still in active use, the problem of its preservation has not yet arisen.

The construction of the proposed Site No. 7 Diked Disposal Area will not affect the lighthouse since it is outside the range of any activities that would be associated with building the pipeline or the containment area. A temporary adverse visual effect would accrue to the U. S. Coast Guard Station during the period for the construction of the pipeline, but there would be no permanent adverse effect following the completion of the pipeline installation. There would be no basic changes in the appearance of the area or the activities currently associated in and around Lorain Harbor once the pipeline is in operation.

Except for the remote possibility that some remains of

prehistoric site CM 33 Lo 1 may still exist, as mentioned previously, there are no historic, prehistoric, or existing cultural resources that can be expected to be, directly or indirectly, adversely affected by the proposed project. There are no remaining cultural resources other than the lighthouse and the U. S. Coast Guard Station that could possibly qualify for inclusion on the National Register. In the event evidence for prehistoric site CM 33 Lo 1 would be encountered during the excavation for the pipeline, only immediate archaeological salvage and recording of items and features directly in the path of the pipeline would appear to be warranted. The highly disturbed nature of the soil of this area by many activities since the prehistoric occupation makes the probability of significant features existing intact very low.

Historically, the early Black River community and the present-day city of Lorain have depended upon the harbor and the navigability of the Black River for economic stability. The construction of the proposed Site No. 7 Diked Disposal Area can only add to that stability and the cultural well-being of the community. In addition to serving the need for dredge disposal, it is anticipated that there may be additional protective benefits to the lighthouse, U. S. Coast Guard Station, and more recent structures as the design features of the disposal area will serve as added buffers to

wave erosion and destructive winds coming off Lake Erie over the harbor area.

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3. Lake, D. J., Atlas of Lorain County, Ohio, 1874, Titus, Simmons and Titus, Philadelphia, Pennsylvania.

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6. Vietzen, Colonel Raymond C. "Lorain County's Indians," Pathways of the Pioneers, Vol. 2, No. 3, 1967, Lorain County Historical Society, Elyria, Ohio.

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Appendix I: Significant Former and Presently Extant Historic and Prehistoric Cultural Resources, Lorain Harbor, Ohio.

1. Prehistoric archaeological sites consisting of at least five villages, three burial mounds, and two burial areas as recorded on Plate 3. All of these sites appear to have been destroyed.

2. Historic Indian village on the east shore of the Black River near its mouth. No evidence remains of this village.

3. Structures (houses) of the first permanent settlement by the Moravians at the mouth of the Black River in 1787. No intact remains of this settlement exist today.

4. House of Azariah Beebe built at the mouth of the Black River in 1807. No remains of this house exist today.

5. The Nathan Perry trading post in the area now occupied by the U. S. Coast Guard Station. Built about 1807-1808. No remains. Destroyed by later buildings.

6. John S. Reid home and blockhouse containing also the post office, tavern, inn, and office for the first justice of the peace. Built in 1812 at what

is now the corner of First Street and Broadway. No remains, replaced by later streets and structures.

7. F. E. Church shipyard located on the west side of the Black River just above the mouth in 1818-1819. No remains.

8. A. Jones and W. Murdock shipyard built near the mouth of the Black River in 1820. No remains of this shipyard exist today. Replaced by later structures.

9. The Edison and Tildon iron furnace built on the west bank of the Black River at the foot of 8th Street. Burned to the ground in 1871. Area later occupied by Ranney Fish Company.

10. The Lorain Lighthouse is still in existence. The Great Lakes Historical Society is trying to have it preserved as a major historic landmark.

11. The U. S. Coast Guard Station is still in existence and in use. This structure and the lighthouse are the only major features in the harbor area not altered extensively or replaced since early in the 1900's.

Appendix II: Ships constructed at Lorain (Black River) during the golden age of wooden shipbuilding. List based on G. Frederick Wright, A Standard History of Lorain County, Ohio, pp. 305-308, 1916.

Name	Year	Builder
General Huntington	1819	F. Church
Schooner Ann	1821	F. Church
Young Amaranth	1825	F. Church
Nucleus	1827	William Wilson
Sloop William Tell	1828	Captain A. Jones
Schooner President No. 1	1829	Captain A. Jones
Steamer General Graciot	1831	Captain A. Jones
Schooner White Pigeon	1832	W. and B. B. Jones
Schooner Globe	1832	Captain A. Jones
Brig John Henzie	1833	W. and B. B. Jones
Schooner Nancy Dousman	1833	Captain A. Jones
Brig Indiana	1834	W. Jones; A. Gilmore
Schooner Florida	1834	W. and B. B. Jones
Schooner Juliette	1834	W. and B. B. Jones
Sloop Lorain	1834	Ed Gillmore, Jr.
Schooner St. Joseph	1835	F. N. Noyes
Schooner Texas	1836	J. Hamblin
Schooner Erie	1836	F. N. Jones
Brig Ramsey Crooks	1836	G. W. Jones
Brig North Carolina	1834	J. Hamblin
Steamer Bunker Hill	1837	F. N. Jones
Steamer Constellation	1837	A. Gillmore
Steamer Lexington	1838	F. N. Jones
Sloop Randolph	1837	Captain A. Jones
Schooner Algonquin	1839	G. W. Jones
Schooner Tom Corwin	1840	G. W. Jones
Schooner Marion	1841	Captain Thomas Cobb
Schooner President No. 2	1841	F. N. Jones
Schooner George Watson	1841	G. W. Jones
Brig Rosa	1841	F. N. Jones
Brig Hoosier	1842	F. N. Jones
Brig Alert	1842	F. N. Jones
Schooner Equador	1842	F. N. Jones
Schooner Acorn	1842	Captain Thomas Cobb
Schooner Trenton	1843	W. S. Lyons
Schooner Endora	1843	T. Cobb
Schooner Andover	1844	William Jones
Schooner Farmer (rebuilt)	1844	D. Rogers
Schooner Magnolia	1845	W. S. Lyons
Schooner John Erwin	1845	Cobb & Burnell
Schooner Thomas G. Colt	1846	William Jones

Appendix II (Cont'd.)

Name	Year	Builder
Schooner W. A. Adair	1845	T. H. Cobb
Steamer H. Hudson	1846	Jones & Company
Brig Emerald	1844	Joseph Keating
Brig Concord	1846	W. S. Lyons
Schooner Palestine	1847	J. Keating
Schooner T. L. Hamer	1847	W. S. Lyons
Schooner Rambler	1847	Benjamin Flint
Schooner Samuel Strong	1847	Captain T. Cobb
Propeller Delaware	1847	Cobb. Burnell & Co.
Propeller Ohio	1848	S. D. Burnell
Schooner Vincennes	1846	W. S. Lyons
Brig Eureka	1847	S. D. Burnell
Schooner Asia	1848	Captain T. Cobb
Brig A. R. Cobb	1841	Captain T. Cobb
Brig Mahoning	1846	William Jones
Schooner Florence	1848	W. S. Lyons
Propeller Henry Clay (rebuilt)	1851	William Jones
Schooner T. P. Handy	1849	William Jones
Schooner Meridian	1848	William Jones
Schooner Abagail	1846	Lyons & Fox
Bark Buckeye State	1852	Mr. Hubbard
Schooner J. Reid	1852	W. S. Lyons
Schooner Winfield Scott	1852	William Jones
Schooner Main	1852	W. S. Lyons
Schooner Hamlet	1852	William Jones
Schooner H. C. Winslow	1853	William Jones
Schooner W. F. Allen	1853	Jones & Co.
Schooner City	1853	D. Rogers
Schooner Cascade	1853	William Jones
Schooner H. E. Mussey	1853	Benjamin Flint
Schooner Wings of the Morning	1854	Jones & Co.
Schooner Peoria	1854	A. Gillmore
Propeller Dick Pinto	1854	G. W. Jones
Schooner G. L. Newman	1855	B. Flint
Schooner Drake	1855	Jones & Co.
Bark Lemuel Crawford	1855	Jones & Co.
Schooner Kyle Spangler	1856	William Jones
Schooner Leader	1856	Lyons & Gillmore
Schooner W. H. Willord	1856	Charles Hinman
Schooner John Webber	1856	Charles Hinman
Schooner Grace Murray	1856	William Jones
Schooner L. J. Farwell	1856	William Jones
Bark David Morris	1857	William Jones
Schooner Return	1855	D. Fox

Appendix II (Cont'd.)

Name	Year	Builder
Schooner Herald	1857	William Jones
Schooner Freeman	1855	William Jones
Schooner Ogden	1857	William Jones
Bark Levi Rawson	1861	William Jones
Bark William Jones	1862	Jones & Co.
Schooner Alice Curtis	1858	Edwards
Propeller Queen of the Lakes	1855	William Jones
Brig Audubon	1855	William Jones
Schooner John Fretter	1853	Charles Hinman
Schooner E. F. Allen	1862	A. Gillmore
Bark Franz Sigel	1862	G. W. Jones
Bark Orphan Boy	1862	William Jones
Conrad Reid	1862	H. D. Root
H. D. Root	1863	H. D. Root
Minerva	1863	William Jones
William H. Chapman	1865	H. D. Root
Schooner Fostoria	1865	W. S. Lyons
Pride	1866	H. D. Root
W. S. Lyons	1866	W. S. Lyons
Bark Summer Cloud	1864	Lester Smith
Schooner Lillie Fox	1866	D. Fox
Kate Lyons	1866	William Jones
Bark P. S. Marsh	1867	G. W. Jones
Schooner H. C. Post (rebuilt)	1866	Thomas Wilson
General Q. A. Gillmore	1867	Thomas Wilson
H. G. Cleveland	1867	William Jones
Clough	1867	D. Fox
Vernie Blake	1867	H. D. Root
Thomas Wilson	1868	Thomas Wilson
Brig E. Cohen	1867	H. D. Root
Thomas Gawn	1872	John Squires
Barge Sarah E. Sheldon	1872	Quelos & Peck
Mary Groh	1873	H. D. Root
Steamer Charles Hickox	1873	H. D. Root
Steam Barge Egyptian	1873	Quelos & Peck
Schooner Our Son	1875	H. Kelley
Schooner Sumatra	1873	Quelos & Peck
Schooner Three Brothers	1873	H. D. Root

Appendix III: Bibliography and References for the History of the Lorain Lighthouse Station.

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6. " " " : July 18, 1950
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8. " " " : June 5, 1953
9. " " " : September 23, 1953
10. " " " : August 4, 1960
11. " " " : October 1, 1960
12. " " " : July 12, 1965
13. " " " : August 7, 1965
14. " " " : July 31, 1965
15. Chronicle Telegram-Elyria: May 10, 12, 1966
16. " " " : November 10, 1965
17. " " " : December 30, 1965
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Appendix III (Cont'd.)

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23. " " " : July 31, 1971

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3. The Great Lakes Historical Society, Vermilion, Ohio.

4. The Lorain Journal microfilm records.

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6. The Lorain County Recorders Office, Elyria, Ohio.

7. The Lorain County Treasurers Office, Elyria, Ohio.

8. The Lorain City Engineers Office, Lorain, Ohio

   a. Map file number X-16

      Map file number Y-75 (A Coast Guard Plot Plan #101238 for the Lorain Lifeboat Station.

PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS
ON
LORAIN HARBOR
OHIO

APPENDIX D
FISH AND WILDLIFE COORDINATION

United States Department of the Interior
FISH AND WILDLIFE SERVICE
East Lansing Area Office
Manly Miles Building, Room 202
1405 South Harrison Road
East Lansing, Michigan 48823

IN REPLY REFER TO:

JAN 22 1981

Colonel George P. Johnson
District Engineer
U. S. Army Engineer District
Buffalo
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Johnson:

This is our Intermediate Report regarding proposed commercial navigation improvements to Lorain Harbor, Lorain County, Ohio.

These comments have been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and in compliance with the intent of the National Environmental Policy Act of 1969.

Sincerely yours,

John Popowski
Area Manager

Lorain Harbor, Ohio

Commercial Navigation Improvements

Preliminary Feasibility Report

An Intermediate Fish and Wildlife Coordination Act Report

Submitted to:

Buffalo District
U. S. Army, Corps of Engineers
Buffalo, New York

Prepared by:

Columbus Field Office
Division of Ecological Services
U. S. Fish and Wildlife Services
Columbus, Ohio

Released from:

East Lansing Area Office
U. S. Fish and Wildlife Service
East Lansing, Michigan

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List of Tables and Figures

PROJECT DESCRIPTION

Sixteen alternative navigation improvements to allow commercial vessels larger than 730 feet in length to use Lorain Harbor are presently being considered. Each alternative is being analyzed under two navigation options: (Option 1) a maximum navigable ship size of 1,000 feet and (Option 2) a maximum navigable ship size of 1,200 feet. The sixteen alternatives can be grouped into three concepts:

Concept 1 (Alternatives 9 thru 16) - Construct a transshipment facility in the Outer Harbor and use either truck, rail, special river vessel, or conveyor to move material upriver. Alternatives 13 thru 16 are identical to Alternatives 9 thru 12 except that they also include the construction of a new channel thru Riverside Park to provide access to the American Shipbuilding Company docks.

Concept 2 (Alternatives 5 thru 8) - Widen and deepen the lower 9,000 feet of the Inner Harbor channel to allow the design vessels to navigate to the Lower Turning Basin.

Concept 3 (Alternatives 1 thru 4) - Widen and deepen the lower 14,000 feet of the Inner Harbor channel to allow the design vessels to navigate to the Upper Turning Basin.

STUDY AREA

In order to assess the potential impacts on fish and wildlife resources of the sixteen navigation alternatives being considered, the Columbus Field Office of the U. S. Fish and Wildlife Service conducted a Four-Season Biological Survey of the Lorain Harbor area. The majority of the study was conducted from October 1978 to October 1979. The study area included the Outer Harbor area and the lower Black River and associated riparian habitat to a point approximately three miles upstream of the Upper Turning Basin.

STUDY METHODS

The general physical characteristics of the study area were determined from aerial photographs and from several boat trips along the lower six miles of the river. A number of areas, including the wetland immediately downstream of the 21st Street Bridge, were more extensively examined during ground surveys. General chemical characteristics were determined from available published literature and from personal communication with Ohio Environmental Protection Agency personnel. Fishery information was obtained from published literature, from personal communication with Dr. Andrew White (John Carroll University) and Ohio Division of Wildlife personnel, and from surveys made by Service personnel utilizing boat-mounted and backpack electrofishing gear, and trap nets. Bird use in the study area was determined from sitings during Service surveys and from information supplied by Mr. Richard Van Deusen and Mr. John Pogacnik of the Black River Chapter of the Audubon Society. Use of the study area by reptiles, amphibians, and mammals was determined from published literature and by sitings of the animals, their tracks, or scats. Recreational use in the study area was determined during Service field surveys and from data supplied by the Ohio Division of Wildlife.

DESCRIPTION OF RESOURCES

Physical Environment

The total water surface area of the Lorain Outer Harbor exclusive of the Lake Approach Channel is approximately 180 acres. Approximately 80 acres of this area is presently dredged by the Corps of Engineers or by private concerns for commercial navigation. Approximately 70 acres of undredged bottom habitat remains on the east side of the harbor and approximately 30 acres remain on the west side. The east side of the harbor is bounded by the east rubble mound breakwater (2,020 feet) and the east sheet steel breakwater shorearm (2,323 feet). Lakeward of the Outer Harbor is the outer sheet steel breakwater (2,180 feet) with riprap toe protection. The shoreline parallel to Lakeside Avenue is a moderately sloping substrate of gravel and cobble. A portion of the east side of the Lorain Sewage Treatment Plant pier is protected with large riprap. The west side of the harbor is bounded by a rubble mound breakwater (4,000 feet). The majority of the undredged western portion of the harbor is shallow with a substrate of sand. The cooling water intake for the Ohio Edison Edgewater Generating Station is located in this area.

The Inner Harbor consists of the lower three miles of the Black River which is dredged to a depth of 27 feet for commercial navigation. Only narrow strips of shallow water habitat remain on either side of the commercial channel in this area. The river is bulkheaded with sheet steel from the mouth to the Erie Avenue Bridge, along the American Shipbuilding Company property, and along the south side of the Upper Turning Basin. Most of the rest of shoreline of the Inner Harbor consists of steep eroding banks with some outcroppings of shale. The only area with a rather gently sloping shoreline is the wetland area immediately below and downstream of the 21st Street Bridge. On a field survey on July 10, 1979, approximately 50% of the wetland was covered with up to six inches of water and most of the rest of the soil area was saturated. Two storm sewers discharge into the wetland. One is located immediately east of the bridge and its effluent flows to the northwest through the wetland. The other is located approximately 2/3 of the way from the bridge to the west end of the wetland and its flow is to the north. Along the riverward edge of the wetland were a number of large fallen trees. Also along this edge and along the edges of the storm sewer discharge rivulets were arrowhead, river bulrush, smartweeds, jewelweed and other broad-leaved emergents. They formed two areas that covered approximately 20% of the total wetland surface area. Broad-leaved cattail was the dominant species in the wetland, covering approximately 75% of the surface area. The other 5% of the wetland was covered by a number of large black willow trees, and scattered clumps of meadow emergents. In all the standing water areas there was a dense growth of filamentous green algae and a limited growth of duckweed (Lemna minor). Along the south edge of the wetland a narrow band of old field herbaceous species blended into the woodland and fill areas. The vegetative species found in each zone are listed in Table 1. A vegetative cover map of the wetland is included as Figure 1. The area of the wetland dominated by broad-leaved emergents appears to have decreased since the 1975 survey done by your Environmental Section. This change in vegetative cover types may be the result of decreased lake levels. The average summer high water level for the three years preceeding our field surveys was approximately one foot lower than the average summer high water level for the three years preceeding the 1975 survey.

The three mile section of the river investigated above the Upper Turning Basin is narrower than the lower three miles. Water depths are controlled by lake water levels and range from four to eight feet at normal flow. Most of the shoreline is relatively low with a

steep eroded face. Much of the riparian habitat along the south bank by the U. S. Steel Plant has been replaced by a high, steep berm set back only a shore distance from the river. Much of the habitat on the opposite bank and on the island is woodland that is intermittently flooded. Within this area (the riverward edge of Cromwell Park) are several pockets of marsh and shrub swamp. Numerous fallen trees provide cover in this section of the river.

Chemical Environment

The chemical water quality throughout the six miles of river investigated during the study is seriously degraded. Major contributors to this degradation include industries in Elyria, the Elyria Sewage Treatment Plant, and the U. S. Steel Company. A chemical waste dump immediately across the river from the Elyria Sewage Treatment Plant may also be a major source of pollutants and is presently being investigated by the Environmental Protection Agency. Both banks of the river in the vicinity of the U. S. Steel Plant were covered with a thick coat of oil from the discharges of U. S. Steel. An oil skimmer boom was found stretched across the river in the area on several occasions in the summer of 1979. Also, oil was seen entering the river from a storm sewer on the south side of the river immediately upstream of the 21st Street Bridge. The Lorain Sewage Treatment Plant on the east pier at the mouth of the river contributes to water quality problems in the lower river and Outer Harbor area. The sediments of both the Inner and Outer Harbor are polluted but those of the Inner Harbor are more heavily polluted than those of the Outer Harbor for the following parameters: volatile solids, COD, nitrogen, phosphorous, oil and grease, iron, chlorine, lead, and zinc.

Fishery Resource

A moderately diverse fish community persists in Lorain Harbor in spite of rather limited physical habitat and degraded water quality. At least 47 species of fish in one or more life stages have been found in the Outer Harbor area within the last ten years. At least 39 of these species and two additional species have also been collected in the lower six miles of the Black River during this same time period. Table 2 lists the fish species found as juveniles or adults in the Outer Harbor, lower Black River, and upper Black River. Gizzard shad and emerald shiners are the dominant fish species in both the Outer Harbor and lower river. Approximately 67 million gizzard shad and 2 million emerald shiners were impinged on the screens of the Ohio Edison Edgewater Generating Station in a one-year period (April 1977 thru March 1978). Almost 90 percent of this impingement occurred between October 25 and December 26, 1977. Other very common species in the Outer Harbor include freshwater drum, smelt, white bass, spottail shiner, trout-perch, and yellow perch. Trout-perch are also very common in the lower river along with carp, brown bullhead, and white sucker. The three areas within the Inner Harbor that generally produced the highest numbers of fish during our collections were: the area described as Cut C-1 (west bank immediately upstream of Erie Avenue Bridge), the shallow water area along the edge of the 21st Street wetland, and the shallow edge along the north bank of the Upper Turning Basin. Even in these areas the number of game fish was very low in comparison to the number of rough and forage fish. Occasional episodes of high concentrations of chlorine or organic matter from the Elyria Sewage Treatment Plant temporarily eliminate fish from the lower Black River by killing them or forcing them to move downstream to the lake. The establishment of a resident game fish community under such conditions is difficult.

Table 3 indicates the relative abundance of fish species found as larvae in the Outer Harbor. The relative abundance information was determined from entrainment data for the Edgewater Generating Station and from standard ichthyoplankton net surveys (Geo-Marine, Inc. 1978). Such collection techniques generally underestimate the concentration of larvae of centrachids, ictalurids, and other fish that remain in close proximity to the substrate. Such fish may be utilizing the west rubble mound breakwater and the riprap on the east side of the Outer Harbor as larvae, juveniles, and adults to a greater extent than has been documented in fishery surveys of the harbor. This possibility can be seen by examining the sport fish harvest data for shore fishermen presented in Table 4. Channel catfish and smallmouth bass appear far more often in the sport fishing harvest than they do in normal scientific collections from the harbor. The three areas from which the harvest data were collected are the municipal pier (hot water discharge from the Edgewater Generating Station), the Lorain Sewage Treatment Plant pier, and the East Breakwater shorearm. The sport fish harvest data for local boat fishermen is shown in Table 5. It is impossible to separate the portion of the catch derived from the harbor area as the boat fishermen had access to waters from Vermillion to Avon. There is heavy fishing pressure by boat anglers seeking yellow perch from late September to early November along the inside and outside of the outer breakwater. Some crappie fishing occurs along the riprap along the confined disposal facility and some ice fishing for smelt occurs just east of the disposal facility. There appears to be little fishing pressure on the lower Black River. Only one fishing boat (just upstream of the Upper Turning Basin) and one party of shore anglers (west side of river by M & W Railroad Bridge) were observed during our study. Table 6 lists the common and scientific names of all the fish species found in the Black River drainage and Outer Harbor area.

Avian Resource

Southcentral Lake Erie, including Lorain Harbor, is located on the eastern edge of the Mississippi Flyway and the western edge of the Atlantic Flyway. Ducks, geese, and swans move through the area on their spring and fall migrations between their wintering grounds on the Atlantic and Gulf coasts and their breeding grounds in the prairie states, Canada, and Alaska (Linduska, 1964). Major north-south and east-west migration corridors for the following species (presented in approximate decreasing order of number of migrants) traverse southcentral Lake Erie: lesser scaup, American wigeon, mallard, red-breasted merganser, canvasback, blue-winged teal, redhead, greater scaup, pintail, whistling swan, ruddy duck, bufflehead, common goldeneye, green-winged teal, Canada goose, northern shoveler, wood duck, gadwall, common merganser, black duck, ring-necked duck, and hooded merganser. Some mallards, wood ducks, Canada geese, and black ducks also breed in Ohio. Red-breasted mergansers, common mergansers, and common goldeneyes regularly over-winter on Lake Erie (Bellrose, 1976). The habitat offered by Lorain Harbor appears to be much more attractive to diving ducks than to dabbling ducks. An examination of Table 7 indicates that diving ducks such as lesser scaup, greater scaup, canvasback, redhead, bufflehead, red-breasted merganser, common merganser, and ruddy duck are abundant to common in the Outer Harbor while the only commonly observed dabbling duck is the mallard. The lack of vegetated, shallow water areas within the Outer Harbor discourages the use of the area by most dabbling ducks. Many of the diving ducks, besides using the area as a resting place during migrations, find ample food in the form of abundant gizzard shad and emerald shiner populations mentioned earlier in this report. Late fall migrants and winter residents also find open water in the west side of the Outer Harbor due to the heated effluent from the Edgewater Generating Station. Data in Table 7 indicate that over-wintering ducks are more concentrated in the west Outer Harbor than

in the east Outer Harbor, which is often frozen over. The same conditions that attract diving ducks also attract herring gulls, ring-billed gulls, and Bonaparte's gulls. The gulls generally outnumber all other waterbirds in the harbor area. Table 8 presents four years data from the annual Christmas bird census conducted by members of the Black River Audubon Society. The heavy use of the Outer Harbor area by waterfowl, particularly scaup, provides opportunity for some waterfowl hunting from blinds constructed on the west rubble mound breakwater. Several blinds have also recently been constructed on the outside of the confined disposal facility. Some diving ducks also utilize the lower reach of the Black River. However, the number of such birds on the river is generally much lower than the number of birds utilizing the Outer Harbor. A typical example of this comparative use was seen during a preliminary field trip by Service biologists in early April of 1978. At least 40 scaup, 8 bufflehead, 2 canvasback, and 2 redhead were present in the Inner Harbor area while several hundred scaup, merganser, and other waterfowl were present in the Outer Harbor. The comparison was even more dramatic on a field trip on March 15, 1979 as documented in Table 9. There were generally larger numbers of waterfowl using the river in the spring than in the fall.

The only evidence of waterfowl production in the harbor area was the sighting of a hen mallard with four young on July 10, 1979 by Service biologists in the wetland by the 21st Street Bridge. Other avian species sighted in the wetland that day included another pair of mallards, nesting red-winged blackbirds, one green heron, nine adult and one immature black-crowned night herons, song sparrows, and three spotted sandpipers. Great blue herons, green herons, and belted kingfishers were commonly seen feeding in the wetland and along the river above the Upper Turning Basin. A red-tailed hawk was observed on several occasions hunting over the wetland, using a dead tree as a perch. All of the avian species sighted by Service personnel during the study are listed on Table 10. The scarcity of nonwater-oriented species on the list is a reflection of effort rather than actual abundance. The wooded area shown as Cut D, the shrub area shown as Cut G, and the riparian habitat upstream of the Upper Turning Basin all provide suitable habitat for a number of species but were not intensively surveyed. A number of old song bird nests were noted in the shrubs in the Cut G area. Table 11 is a checklist of avian species seen in the vicinity of Lorain Harbor and the lower Black River by members of the Black River Audubon Society from 1977 thru 1979. Many of the listed species would be expected to utilize the aforementioned habitat along the lower Black River.

Other Wildlife Resources

Other wildlife observed during the study was concentrated in the 21st Street wetland, Cut D, Cut G, and the river area upstream of the Upper Turning Basin. The persistent emergent cover in the wetland provides shelter for small mammals such as eastern cottontail, shrews, mice, and voles. Numerous muskrat and raccoon tracks were observed during late fall in the areas where broad-leaved emergents are withered and matted in mud flats. One muskrat lodge was located in the wetland. A snapping turtle was also observed in the wetland. A local hunter and trapper indicated that muskrat and raccoon were also common around the marsh potholes on the north side of the river just downstream of the island (across from the U. S. Steel Plant). Snapping turtles were regularly caught in trap nets set in the back channel on the north side of the island. The woodland and shrub habitat upstream of the Upper Turning Basin, and in Cuts D and G would be expected to support small mammals such as eastern cottontail, raccoon, opossum, squirrel, shrews, mice, and voles. Amphibians would also be expected to utilize the wet woodland habitat of the island and downstream area, and the 21st Street wetland. A number of mudpuppies (*Necturus maculosus*) are impinged each year at the Edgewater Generating Station, indicating some use of the west Outer Harbor area by this species.

IMPACTS OF PROPOSED ALTERNATIVES

The environmental impacts of the proposed work can be divided into impacts on the aquatic system of the Outer Harbor, impacts on the aquatic system of the Inner Harbor, impacts on the riparian habitat of the Inner Harbor, and unspecified impacts of disposal of material generated from dredging and bank cutting.

The major impact of work in the Outer Harbor involves the deepening of previously undredged areas to enlarge the turning areas and to create a new channel leading to the Riverside Park cut, if it is made. All of this new dredging would occur in the 70 acres of presently undredged habitat on the east side of the Outer Harbor. Alternatives 1, 5, 13, 14, 15, and 16 contain the Riverside Park cut and would require the dredging of approximately 32 acres of previously undredged bottom habitat. The other ten alternatives do not contain the Riverside Park cut and would require approximately 20 acres of new dredging. The conversion of relatively shallow, undisturbed areas into deep, annually dredged areas will decrease the spawning potential of the areas, reduce the benthic production of the areas, and reduce the annual fish biomass production of the areas. Bullheads, channel catfish, crappie, sunfish, and mottled sculpin would be expected to have used this shallow water habitat as a spawning, nursery, and feeding area. Smallmouth bass and yellow perch would have used the habitat as a nursery area while freshwater drum would have utilized the habitat as a juvenile and adult feeding area. The Outer Harbor work will probably not have a significant impact on the use of the area by waterbirds. The fish-eating birds are probably depending primarily on gizzard shad and emerald shiners, both of which are plankton feeders and unlikely to be seriously impacted by the Outer Harbor work.

The major impact of work in the Inner Harbor also involves the elimination of much of the remaining shallow water habitat. Concept 3 (Alternatives 1 thru 4) would involve the elimination of more than one half of the narrow band of shallow water habitat bordering the navigation channel between the river mouth and the Upper Turning Basin. The work would involve the bulkheading of more than 3,100 feet of the proposed bank cuts for Option 1 and 3,600 feet for Option 2. Concept 2 (Alternatives 5 thru 8) would involve the elimination of approximately one third of the shallow water habitat remaining in the Inner Harbor. Approximately 2,500 feet of the proposed bank cuts would be bulkheaded under Option 1 and 3,000 feet under Option 2. Many of the fish species persisting in the Inner Harbor are dependent on the remaining shallow water areas and the limited cover provided therein. If spawning is occurring in this section of the river, in spite of the water quality degradation, it is probably occurring in the shallow water areas. The extensive bank cutting and bulkheading proposed under Concepts 2 and 3 would appreciably decrease the amount of habitat present in the Inner Harbor for spawning, nursery, and feeding. The species most seriously affected would be similar to those listed for the Outer Harbor.

The extensive bank cuts proposed under Concepts 2 and 3 will eliminate some productive riparian habitat. Implementation of Concept 3 (Alternatives 1 thru 4) would result in the loss of 12.5 acres of wooded habitat in Cut D and 6.5 acres of shrub habitat in Cut G under Option 1 and 7.5 acres under Option 2. Concept 2 (Alternatives 5 thru 8) would involve the loss of the 12.5 acres of wooded habitat in Cut D. The rest of the proposed bank cuts under Concepts 2 and 3 involve areas that have very limited wildlife values because of prior commercial development. The wooded area in Cut D and the shrub area in Cut G presently support a number of small mammals and song birds that will be forced to move to nearby habitat if the bank cuts are made. As most wildlife habitats are at carrying capacity, the displaced organisms or their equivalents will eventually perish.

A potentially more serious impact on the terrestrial community involves the method and site for the disposal of material generated from the dredging and/or bank cutting proposed under the 16 alternatives. Table 12 indicates the approximate cubic yardage of material generated from work in the Outer Harbor and Inner Harbor for Options 1 and 2 for each of the 16 alternatives. It can be seen that the maximum potential amount involved is over five million cubic yards under Option 2 of Alternative 1 while the minimum amount involved is approximately one million cubic yards for either option under Alternatives 9, 11, or 12. Each one million cubic yards would require a disposal site of over 30 acres if the material were piled to a height of 20 feet and thus the disposal of the dredged material could impact more terrestrial wildlife habitat than the maximum proposed bank cutting. The calculated amounts for the Outer Harbor work include all dredging required in the Lake Approach Channel, the Outer Harbor proper, any dredging necessary for a new approach channel to the Riverside Park cut, and any dredging necessary for a lakefront transshipment slip. All of the dredging amounts calculated for the Outer Harbor in the Preliminary Engineering Designs and Cost Estimates by Michall Baker, Jr., Inc. appear to be grossly underestimated. Underestimates appear to range from approximately 700,000 to 1,181,000 cubic yards for the 16 alternatives considered. The amount of material required to be removed to create a special vessel loading area in the Inner Harbor appears to have been underestimated by 220,000 cubic yards for Alternative 10 and by 130,000 cubic yards for Alternative 14. The amounts shown in Table 12 have been corrected to more closely approximate what we believe to be the actual amounts of required dredging and bank cutting for each of the 16 alternatives. The cost estimates for Alternatives 9, 11, and 12 in the Baker analysis show $533,000 for dredging and bank cutting in the Inner Harbor. As we understand these alternatives, there would be no dredging or bank cutting in the Inner Harbor.

MITIGATION DISCUSSION

All of the proposed alternatives avoid significant direct impacts on the 21st Street wetland. As this wetland was found to be a productive and unique habitat in the study area, it should continue to be protected from any future filling or dredging. None of the habitat that would be directly impacted by the 16 proposed alternatives was determined to be so productive or unique that its protection would warrant the elimination or major modification of any of the proposed alternatives. However, with implementation of the National Pollution Discharge Elimination System, water quality improvements can be expected in Lorain Harbor in the foreseeable future. These improvements would be of limited benefit to the fish and wildlife community of Lorain Harbor if the physical habitat upon which species depend for reproductive substrate, nursery areas, forage production, and resting cover was substantially reduced in the process of improving the navigable capacity of the harbor. If appropriate habitat improvements can be developed to mitigate some of the resource losses associated with the construction of the selected alternative, those improvements should be included as part of the final construction plan. General mitigation approaches are outlined below for each of the major areas of potential habitat loss.

Mitigation for the loss of a portion of the shallow water habitat in the east Outer Harbor area would have to involve an attempt to increase the amount of productive habitat available in the remaining shallow water areas of the Outer Harbor. This might involve the placement of various sized riprap in some areas where such habitat is presently lacking. A more thorough analysis of the physical nature of the habitat to be modified by dredging and the remaining shallow water habitat would be required.

Mitigation for the loss of shallow water habitat in the Inner Harbor would involve an approach similar to that suggested for the Outer Harbor. Bank cuts that were not to be bulkheaded might be benched slightly so that some riprap could be placed along the slopes in two to six feet of water.

Mitigation for the loss of riparian habitat along the Inner Harbor will be difficult as navigational improvements to Lorain Harbor will probably lead to increased commercial development of the terrestrial habitat adjoining the Inner Harbor. The securing of protective easements on riparian habitat immediately upstream of the Upper Turning Basin may be one way to attempt to protect both fish and wildlife resources from future development.

The mitigation of impacts associated with the disposal of the material generated from new dredging and bank cutting will depend on the careful selection of the method and site of disposal. We will be glad to provide assistance in developing or reviewing disposal plans.

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Table 1. Vegetation of the 21st Street Wetland

See Figure 1 for location of vegetative zones.

Robust emergents:	
Broad-leaved cattail	Typha latifolia
Reed grass	Phragmites communis
Iris	Iris sp.
Broad-leaved marsh emergents:	
Mild water pepper	Polygonum hydropiperoides
Arrowhead	Sagittaria latifolia
Water plantain	Alisma sp.
Swamp milkweed	Asclepias incarnata
River bulrush	Scirpus fluviatilis
Reed canary grass	Phalaris urundinacea
Blue joint grass	Calamogrostis canadensis
Jewelweed	Impatiens capensis
Meadow emergents:	
Swamp rose mallow	Hibiscus palustris
Nettle	Urtica sp.
Nightshade	Solanum dulcamara
Hedge bindweed	Convolvulus sepium
Peppermint	Mentha arvensis
Water horehound	Lycopus americanus
Willow herb	Epilobium glandulosum
Wingstem	Verbicina alternifolia
Wild cucumber	Echinocystis lobata
Bonset	Eupatorium perfoliatum
White snakeroot	Eupatorium rugosum
Old field:	
Goldenrod	Solidago sp.
Canada thistle	Cirsium arvensa
Pokeweed	Phytolacca americana
Beggar ticks	Bidens connata
Blue vervain	Verbena hastata
These plants are shoreward of the robust emergents at the edge of the slope and represent more of an upland habitat.	
Woodland and understory:	
Cottonwood	Populus deltoides
Sugar maple	Acer saccharum
Black willow	Salix nigra
Dogwood	Cornus sp.
Staghorn sumac	Rhus coppallina
Tree of heaven	Ailanthus altissima
Wild grape	Vitas sp.
Honeysuckle	Lonicera sp.
Elderberry	Sambucus canadensis
Hawthorn	Crataegus sp.
Boxelder	Acer negundo
This community vegetates the slope, the downstream limit of the wetland, and portions of the upstream limit.	

Table 2. Relative abundance or presence of fish species as juveniles or adults in Lorain Harbor and Black River.[1]

	Outer Harbor	Lower Black River[2]	Upper Black River[3]
Silver lamprey	x	p	
Sea lamprey	U	p	
Longnose gar	R	R	
Bowfin	R	p	
Alewife	U	p	
Gizzard shad	A	A	p
Mooneye	x	x	
Coho salmon	U	p	
Rainbow smelt	VC	p	
Central mudminnow		x	p
Grass pickerel			p
Northern pike	R	R	p
Muskellunge	x	x	
Stoneroller	U	p	p
Goldfish	C	C	p
Redside dace			p
Carp	C	VC	p
Silverjaw minnow		p	p
Bigeye chub			x
Silver chub	x	x	
Hornyhead chub			x
River chub			x
Golden shiner	U	U	p
Emerald shiner	A	A	p
Striped/common shiner	R	p	p
Bigmouth shiner			p
Blacknose shiner			p
Spottail shiner	VC	C	x
Rosyface shiner			x
Spotfin shiner	U	p	p
Sand shiner	U	R	p
Redfin shiner		x	x
Mimic shiner			x
Southern redbelly dace			p
Bluntnose minnow	x	p	p
Fathead minnow		R	p
Blacknose dace			p
Longnose dace	C		
Creek chub	U	p	p
Quillback	x	R	
White sucker	U	VC	p
Northern hog sucker			p
Spotted sucker	x	x	
Silver redhorse			x
Black redhorse			x
Golden redhorse	R	x	p
Shorthead redhorse	x	x	
Black bullhead	U	p	p
Yellow bullhead	U	x	p
Brown bullhead	U	VC	p
Channel catfish	C	p	x
Stonecat	C	p	
Tadpole madtom		x	

Table 2. continued

	Outer Harbor	Lower Black River[2]	Upper Black River[3]
Brindled madtom	x	x	x
Trout-perch	VC	VC	x
Burbot	x		
Brook silverside	x	x	p
Brook stickleback			p
White perch	p		
White bass	VC	U	p
Rock bass	R	p	p
Green sunfish	U	p	p
Pumpkinseed	U	p	p
Bluegill	C	U	p
Longear sunfish		x	x
Smallmouth bass	U	U	p
Largemouth bass	U	U	p
White crappie	C	U	p
Black crappie	U	p	p
Eastern sand darter	x	x	x
Greenside darter	x	x	p
Rainbow darter			p
Fantail darter			p
Johnny darter	x	x	p
Yellow perch	VC	U	p
Logperch	C	x	x
Channel darter	R		
Blackside darter			p
Sauger	x	x	
Walleye	U	R	
Freshwater drum	VC	U	x
Mottled sculpin	C		p

A - Abundant

VC - Very common

C - Common

U - Uncommon

R - Rare

p - Species collected in indicated section in last ten years but no numerical data available on which to base estimate of relative abundance.

x - Species known to have been found historically in indicated area but no specimen collected in last ten years or more.

1 - Relative abundance determinations for Outer Harbor based on data from Geo-Marine, Inc. (1978) and WAPORA (1977).

Relative abundance determinations for lower Black River based on fishery surveys conducted as part of Four-Season Study.

All presence data (p) based on White (1978) or White (personel communication).

All historical presence data (x) based on Trautman (1957) and White (1978).

2 - Mouth of river upstream to first riffle (just downstream of 31st Street Bridge) and lower one half mile of French Creek.

3 - Black River drainage above first riffle and upper portion of French Creek.

Table 3. Relative abundance of larval fish species in Lorain Outer Harbor.*

Alewife	Rare
Gizzard shad	Abundant
Rainbow smelt	Abundant
Goldfish/carp	Abundant
Emerald shiner	Abundant
Spottail shiner	Abundant
Bluntnose minnow	Common
Unid. cyprinids	Common
Quillback	Uncommon
White sucker	Uncommon
Channel catfish	Uncommon
Trout-perch	Common
Brook silverside	Rare
White bass	Uncommon
Rock bass	Rare
Lepomis spp.	Uncommon
Micropterus spp.	Rare
Pomoxis spp.	Rare
Yellow perch	Common
Logperch	Common
Sauger	Uncommon
Unid. percids	Uncommon
Freshwater drum	Uncommon
Mottled sculpin	Rare

* Based upon data from Geo-Marine, Inc (1978).

Table 4. Sport fish harvest data for shore fishermen in Lorain Harbor.*

	1975	1976	1977
Channel catfish	3,612	653	895
White bass	144,890	36,571	118,395
Smallmouth bass	157	69	366
Yellow perch	84,402	29,836	54,354
Walleye	494	0	83
Freshwater drum	24,457	8,397	6,296
Other species	20,199	10,122	7,709
Total catch	278,611	85,648	188,098
Angler hours	214,151	120,315	130,666

* Baker, C.T., M. Rawson and D.L. Johnson. 1976. Ohio's annual Lake Erie creel census. D.-J. Perf. Rep. F-35-R, Study 3, Final Report. Ohio Dept. Natural Resources, Division of Wildlife. 25 p.

Table 5. Sport fish harvest data for boat fishermen departing from Lorain Harbor and Beaver Creek.*

	1975	1976	1977
Channel catfish	7,365	2,007	1,515
White bass	140,966	42,196	20,212
Smallmouth bass	1,714	0	73
Yellow perch	688,939	302,844	303,282
Walleye	955	3,960	759
Freshwater drum	100,929	7,048	4,844
Other species	8,498	3,444	1,796
Total catch	949,366	361,499	332,481
Angler hours	448,009	182,523	162,398

* Baker, C.T., M. Rawson and D.L. Johnson. 1979. Ohio's annual Lake Erie creel census. D.-J. Perf. Rep. F-35-R, Study 3, Final Report. Ohio Dept. Natural Resources, Division of Wildlife. 25 p.

Table 6. List of common and scientific names of fish species found in Black River drainage and Lorain Harbor.*

Common Name	Scientific Name	
Silver lamprey	Ichthyomyzon unicuspis Hubbs and Trautman	x
Sea lamprey	Petromyzon marinus Linnaeus	
Longnose gar	Lepisosteus osseus (Linnaeus)	
Bowfin	Amia calva Linnaeus	
Alewife	Alosa pseudoharengus (Wilson)	
Gizzard shad	Dorosoma cepedianum (Lesueur)	
Mooneye	Hiodon tergisus Lesueur	x
Coho salmon	Oncorhynchus kisutch (Walbaum)	
Rainbow smelt	Osmerus mordax (Mitchill)	
Central mudminnow	Umbra limi (Kirtland)	
Grass pickerel	Esox americanus vermiculatus Lesueur	
Northern pike	Esox lucius Linnaeus	
Muskellunge	Exox masquinongy Mitchill	
Stoneroller	Campostoma anomalum (Rafinesque)	
Goldfish	Carassius auratus (Linnaeus)	
Redside dace	Clinostomus elongatus (Kirtland)	
Carp	Cyprinus carpio Linnaeus	
Silverjaw minnow	Ericymba buccata Cope	
Bigeye chub	Hybopsis amblops (Rafinesque)	
Silver chub	Hybopsis storeriana (Kirtland)	x
Hornyhead chub	Nocomis biguttatus (Kirtland)	
River chub	Nocomis micropogon (Cope)	
Golden shiner	Notemigonus crysoleucas (Mitchill)	
Emerald shiner	Notropis atherinoides Rafinesque	
Striped shiner	Notropis chrysocephalus (Rafinesque)	
Common shiner	Notropis cornutus (Mitchill)	
Bigmouth shiner	Notropis dorsalis (Agassiz)	x
Blacknose shiner	Notropis heterolepis Eigenmann and Eigenmann	x
Spottail shiner	Notropis hudsonius (Clinton)	
Rosyface shiner	Notropis rubellus (Agassiz)	
Spotfin shiner	Notropis spilopterus (Cope)	
Sand shiner	Notropis stramineus (Cope)	
Redfin shiner	Notropis umbratilis (Girard)	
Mimic shiner	Notropis volucellus (Cope)	
Southern redbelly dace	Phoxinus erythrogaster (Rafinesque)	
Bluntnose minnow	Pimephales notatus (Rafinesque)	

Table 6. continued

Common Name	Scientific Name	
Fathead minnow	Pimephales promelas Rafinesque	
Blacknose dace	Rhinichthys atratulus (Hermann)	
Longnose dace	Rhinichthys cataractae (Valenciennes)	
Creek chub	Semotilus atromaculatus (Mitchill)	
Quillback	Carpiodes cyprinus (Lesueur)	
White sucker	Catostomus commersoni (Lacèpède)	
Northern hog sucker	Hypentelium nigricans (Lesueur)	
Spotted sucker	Minytrema melanops (Rafinesque)	
Silver redhorse	Moxostoma anisurum (Rafinesque)	
Black redhorse	Moxostoma duquesnei (Lesueur)	
Golden redhorse	Moxostoma erythrurum (Rafinesque)	
Shorthead redhorse	Moxostoma macrolepidotum (Lesueur)	
Black bullhead	Ictalurus melas (Rafinesque)	
Yellow bullhead	Ictalurus natalis (Lesueur)	
Brown bullhead	Ictalurus nebulosus (Lesueur)	
Channel catfish	Ictalurus punctatus (Rafinesque)	
Stonecat	Norturus flavus Rafinesque	
Tadpole madtom	Noturus gyrinus (Mitchill)	
Brindled madtom	Noturus miurus Jordan	
Trout-perch	Percopsis omiscomaycus (Walbaum)	
Burbot	Lota lota (Linnaeus)	x
Brook silverside	Labidesthes sicculus (Cope)	
Brook stickleback	Culaea inconstans (Kirtland)	
White perch	Morone americana (Gmelin)	
White bass	Morone chrysops (Rafinesque)	
Rock bass	Ambloplites rupestris (Rafinesque)	
Green sunfish	Lepomis cyanellus Rafinesque	
Pumpkinseed	Lepomis gibbosus (Linnaeus)	
Bluegill	Lepomis macrochirus Rafinesque	
Longear sunfish	Lepomis megalotis (Rafinesque)	
Smallmouth bass	Micropterus dolomieui Lacèpède	
Largemouth bass	Micropterus salmoides (Lacèpède)	
White crappie	Pomoxis annularis Rafinesque	
Black crappie	Pomoxis nigromaculatus (Lesueur)	
Eastern sand darter	Ammocrypta pellucida (Putnam)	x
Greenside darter	Etheostoma blennioides Rafinesque	
Rainbow darter	Etheostoma caeruleum Storer	

Table 6. continued

Common Name	Scientific Name	
Fantail darter	Etheostoma flabellare Rafinesque	
Johnny darter	Etheostoma nigrum Rafinesque	
Yellow perch	Perca flavescens (Mitchill)	
Logperch	Percina caprodes (Rafinesque)	
Channel darter	Percina copelandi (Jordan)	x
Blackside darter	Percina maculata (Girard)	
Sauger	Stizostedion canadense (Smith)	
Walleye	Stizostedion vitreum vitreum (Mitchill)	
Freshwater drum	Aplodinotus grunniens Rafinesque	
Mottled sculpin	Cottus bairdi Girard	

x Listed as an endangered species on the Endangered Wild Animals in Ohio list.

* Follows nomenclature in Bailey (1970).

Table 7. Comparative seasonal use of the west and east halves of the Lorain Outer Harbor by waterbirds.*

	West Outer Harbor				East Outer Harbor			
	Sp	Su	F	W	Sp	Su	F	W
Common loon	o		o	r	u		u	
Red-necked grebe	r			r				
Horned grebe	c		c	r	c		c	
Eared grebe	r							
Pied-billed grebe	u		u	r	c		c	
Gannet		x	x					
Double-crested cormorant	r		o				o	
Great blue heron	o		o		o		o	
Great egret	o		r		o			
Black-crowned night heron	o	r	o	r				
Mute swan	r		r		r		r	
Whistling swan	o		o		o		o	
Canada goose	o		o	o	o		o	
Snow goose			r					
Mallard	c	o	c	c	c	c	c	r
Black duck	u		u	u	u		u	
Gadwall	o		o	r	o		o	
Pintail	o		o	r	o		o	
Green-winged teal	o		o		o		o	
Blue-winged teal	o		o		o		o	
American wigeon	o		o	r	o		o	
Northern shoveler	r		r					
Wood duck	o		o	r	o		o	
Redhead	c		c	u	c		c	r
Ring-necked duck	u		u	r	u		u	
Canvasback	c		c	c	c		c	r
Greater scaup	c		c	c	c		c	r
Lesser scaup	a		a	c	c		a	r
Common goldeneye	c		c	a	c		a	r
Barrow's goldeneye	x							
Bufflehead	c		c	o	u		u	
Oldsquaw	o		o	r	o		o	r
Harlequin duck	r		r	r			r	
Common eider							r	
King eider							r	

Table 7. continued

	West Outer Harbor				East Outer Harbor			
	Sp	Su	F	W	Sp	Su	F	W
White-winged scoter	o		o	o	o		o	r
Surf scoter	r		o	r	r		r	
Black scoter	r		o	r			r	
Ruddy duck	c		c	u	c		c	r
Hooded merganser	u		u	r	o		o	
Common merganser	c		c	u	c		c	r
Red-breasted merganser	a		a	u	a		a	r
American coot	c		c	c	c		c	
Killdeer	o		o	o	u	u	u	
Ruddy turnstone	r		r		o		o	
Spotted sandpiper	o		o	o	u	u	u	
Sanderling			o	x			o	
Red phalarope			r					
Northern phalarope			r					
Pomarine jaeger				x				
Parasitic jaeger			r					
Glaucous gull	o		o	u			r	r
Iceland gull				u				
Great black-backed gull	u		u	c	o	o	o	o
Lesser black-backed gull				r				
Herring gull	a	u	c	a	a	u	a	c
Thayer's gull				o				
Ring-billed gull	a	u	a	a	a	c	a	c
Black-headed gull			r	r				
Laughing gull	r							
Franklin's gull			u	r			u	
Bonaparte's gull	a	o	a	o	a	o	a	r
Little gull			o	o			u	
Black-legged kittiwake			r	r				
Forster's tern			o				o	
Common tern	c		u		c	o	c	
Caspian tern	c	o	c		c	o	c	
Black tern	o		o		r		r	
Belted kingfisher	o	o	o	o	o	o	o	

Table 7. continued

* Personal checklist of John Pogacnik, member of Black River Audubon Society and Lorain resident.

Key:

Sp - (March-May) - ice begins to break up, start of migration

Su - (June-August) - end of migration, summering and nest birds present

F - (September-December) - migration time

W - (January-February) - lake is icing up, birds present are wintering

a - abundant - common, numerous

c - common - can usually be seen

u - uncommon - usually present but in low number

o - occasional - seen a few times a season

r - rare - seen at 2-5 year intervals

x - accidental - strays

Table 8. Christmas census list of Lorain Harbor from Black River Audubon Society

	1979	1978	1977*	1976
Horned grebe	1	2	0	4
Pied-billed grebe	2	1	0	1
Great blue heron	3	4	1	1
Mallard	452	115	467	347
Black duck	33	20	21	10
Gadwall	2	0	0	0
Pintail	0	2	0	0
American wigeon	0	1	0	1
Redhead	23	2	0	3
Ring-necked duck	2	0	0	3
Canvasback	41	50	0	43
Greater scaup	19	1	(2 sp?)	51
Lesser scaup	44	5		75
Common goldeneye	35	537	11	158
Bufflehead	8	20	1	3
Oldsquaw	0	3	0	2
White-winged scoter	0	0	0	2
Black scoter	1	0	0	0
Ruddy duck	30	6	0	100
Hooded merganser	20	0	0	1
Common merganser	3	1	0	125
Red-breasted merganser	13	1	0	26
Great black-backed gull	1	2	0	12
Herring gull	249	705	3,107	25,000
Ring-billed gull	13,252	2,621	15,300	10,000
Bonaparte's gull	6,008	1,050	1,505	256

* Almost entire harbor was frozen and most ducks were far out in lake.

Table 9. Comparative use of Lorain Outer and Inner Harbor areas by waterbirds.*

	Outer Harbor	21st St. Wetland	Upper Turning Basin
Mallard	20	2	6
Redhead	380	2	0
Ring-necked duck	10	4	2
Canvasback	500	0	0
Scaup (greater & lesser)	2,190	0	0
Bufflehead	4	2	0
Common merganser	20	0	0
Red-breasted merganser	300	0	0
Gulls (herring & ring-billed)	3,500	0	0

* Data from March 15, 1979 Service field survey.

Table 10. Seasonal observations of birds in Lorain Harbor and lower reach of the Black River during Four-Season Biological Survey.

Species	Spring	Summer	Fall	Winter
Common loon	x		x	
Horned grebe	x			
Pied-billed grebe	x			
Mallard	x	x	x	
Northern shoveler	x			
Scaup	x		x	
Common goldeneye	x			
Bufflehead	x			
Redhead	x			
Canvasback	x			
Ring-necked duck	x			
Oldsquaw	x			
White-winged scoter	x			
Common merganser	x			
Hooded merganser	x			
Red-breasted merganser	x			
Red-tailed hawk	x			
Great blue heron	x	x		
Green heron	x	x		
Black-crowned night heron		x		
American coot	x		x	
Spotted sandpiper		x		
Herring gull	x	x	x	x
Ring-billed gull	x	x	x	x
Belted kingfisher	x	x	x	
Red-winged blackbird	x	x		
Song sparrow		x		
Blue jay	x	x	x	

Table 11. Black River Audubon Society checklist for birds of Lorain Harbor and lower Black River and associated habitat from 1977 thru 1979.

GREBES	
Horned grebe	M-WV
Pied-billed grebe	M-S-W
HERONS	
Great blue heron	cSR-W
Green heron	cSR
Black-crowned night heron	M-S
Least bittern	SR
SWANS, GEESE	
Mute swan	uM
Whistling swan	M
Canada goose	M-S-W
DUCKS	
Mallard	cSR-W
Black duck	SR-WV
Gadwall	M
Pintail	M
American wigeon	cM
Redhead	M-WV
Ring-necked duck	M-W
Canvasback	M-WV
Greater scaup	M-WV
Lesser scaup	cM-WV
Common goldeneye	cM-WV
Bufflehead	M-WV
Oldsquaw	uW
White-winged scoter	uW
Surf scoter	uW
Ruddy duck	M-W
Hooded merganser	M
Common merganser	cM-W
Red-breasted merganser	cM-W

Table 11. continued

VULTURES, HAWKS, FALCONS	
Turkey vulture	cSR
Sharp-shinned hawk	M-W-S
Cooper's hawk	cPR
Red-tailed hawk	cPR
Red-shouldered hawk	cPR
Broad-winged hawk	SR
American kestrel	PR
RAILS, GALLINULES, COOTS	
Common gallinule	cSR
American coot	sM-S-W
SHOREBIRDS	
Killdeer	cSR-W
Black-bellied plover	M
Ruddy turnstone	M
Common snipe	M
Spotted sandpiper	cSR
Greater yellowlegs	M
Lesser yellowlegs	M
Dunlin	M
Semipalmated sandpiper	M
Sanderling	M
GULLS, TERNS	
Glaucous gull	uW
Iceland gull	uW
Great black-backed gull	WV
Herring gull	cM-SV-WV
California gull	uW
Ring-billed gull	cM-SV-WV
Bonaparte's gull	cM-SV-WV
Little gull	uW
Black-legged kittiwake	uW
Common tern	cM-SV
Caspian tern	M
Black tern	SR

Table 11. continued

DOVES, PIGEONS	
Rock dove	cPR
Mourning dove	cPR
CUCKOOS	
Yellow-billed cuckoo	SR
Black-billed cuckoo	SR
OWLS	
Snowy owl	uWV
GOATSUCKERS	
Common nighthawk	cSR
SWIFTS, HUMMINGBIRDS	
Chimney swift	cSR
Ruby-throated hummingbird	cSR
KINGFISHER	
Belted kingfisher	cSR-W
WOODPECKERS	
Common flicker	cSR-W
Red-bellied woodpecker	PR
Red-headed woodpecker	SR-W
Yellow-bellied sapsucker	cM
Hairy woodpecker	cPR
Downy woodpecker	cPR
FLYCATCHERS	
Eastern kingbird	cSR
Great crested flycatcher	cSR
Eastern phoebe	cSR
Least flycatcher	cM-S
Eastern wood pewee	cSR
LARKS	
Horned lark	PR
SWALLOWS	
Tree swallow	SR
Bank swallow	cSR
Rough-winged swallow	cSR
Barn swallow	cSR
Purple martin	cSR

Table 11. continued

JAYS, CROWS	
Blue jay	cPR
Common crow	cPR
CHICKADEES, TITMICE	
Black-capped chickadee	cPR
Tufted titmouse	cPR
NUTHATCHES, CREEPERS	
White-breasted nuthatch	cPR
Red-breasted nuthatch	M-W
Brown creeper	cM-W
WRENS	
House wren	cSR
Winter wren	M-W
MOCKINGBIRD, THRASHERS	
Grey catbird	cSR
Brown thrasher	cSR
THRUSHES	
American robin	cSR-W
Wood thrush	cSR
Hermit thrush	M
Swainson's thrush	cM
Gray-cheeked thrush	M
Veery	M-S
Eastern bluebird	cSR-W
GNATCATCHERS, KINGLETS	
Blue-gray gnatcatcher	cSR
Golden-crowned kinglet	cM-W
Ruby-crowned kinglet	cM
PIPITS, WAXWINGS	
Cedar waxwing	PR
SHRIKES, STARLINGS	
Loggerhead shrike	SR
Starling	cPR

Table 11. continued

VIREOS	
White-eyed vireo	uM-S
Solitary vireo	M
Red-eyed vireo	cSR
Warbling vireo	cSR
WARBLERS	
Black-and-white warbler	cM
Golden-winged warbler	M
Blue-winged warbler	SR
Tennessee warbler	cM
Nashville warbler	cM
Yellow warbler	cSR
Magnolia warbler	cM
Cape May warbler	cM
Black-throated blue warbler	M
Yellow-rumped warbler	cM-W
Black-throated green warbler	cM-S
Blackburnian warbler	cM
Chestnut-sided warbler	cM
Bay-breasted warbler	cM
Blackpoll warbler	cM
Pine warbler	M
Prairie warbler	uM
Palm warbler	cM
Ovenbird	SR
Common yellowthroat	cSR
Yellow-breasted chat	SR
Wilson's warbler	M
Canada warbler	cM
American redstart	cSR
WEAVER FINCHES	
House sparrow	cPR
BLACKBIRDS, ORIOLES	
Red-winged blackbird	cSR-W
Northern oriole	cSR
Common grackle	cSR-W

Table 11. continued

TANAGERS	
Scarlet tanager	cSR
GROSBEAK, FINCHES	
Cardinal	cPR
Rose-breasted grosbeak	cSR
Indigo bunting	cSR
Evening grosbeak	uW
Purple finch	M-S-W
Common redpoll	uW
American goldfinch	cSR-W
Rufous-sided towhee	cSR-W
SPARROWS	
Savannah sparrow	cSR-W
Dark-eyed junco	cWV
Tree sparrow	cWV
Chipping sparrow	cSR
Field sparrow	cSR-W
White-crowned sparrow	cM-W
White-throated sparrow	cM-W
Fox sparrow	M
Song sparrow	cPR
Snow bunting	WV

Symbols used:

c - common
u - uncommon
M - transient visitor, migrant
PR - permanent resident, breeds
S - may occur in summer, may breed
SR - summer resident, breeds
SV - summer visitor, does not breed
W - may occur in winter, irregularly
WV - regular winter visitor

Table 12. Required amounts of dredging and bank cutting for the sixteen proposed navigation improvement alternatives in Lorain Harbor.

All amounts are in cubic yards

Alternative No.	Outer Harbor: Options 1 & 2	Inner Harbor: Option 1	Inner Harbor: Option 2
1	1,270,000	3,644,100	3,988,000
2	910,000	3,493,000	4,004,000
3	910,000	3,493,000	4,004,000
4	910,000	3,493,000	4,004,000
5	1,270,000	2,187,200	2,320,800
6	910,000	2,036,100	2,326,800
7	910,000	2,036,100	2,326,800
8	910,000	2,036,100	2,326,800
9	1,030,000	0	0
10	1,030,000	260,000	260,000
11	1,030,000	0	0
12	1,030,000	0	0
13	1,410,000	456,800	554,300
14	1,410,000	626,800	724,300
15	1,410,000	456,800	554,300
16	1,410,000	456,800	554,300

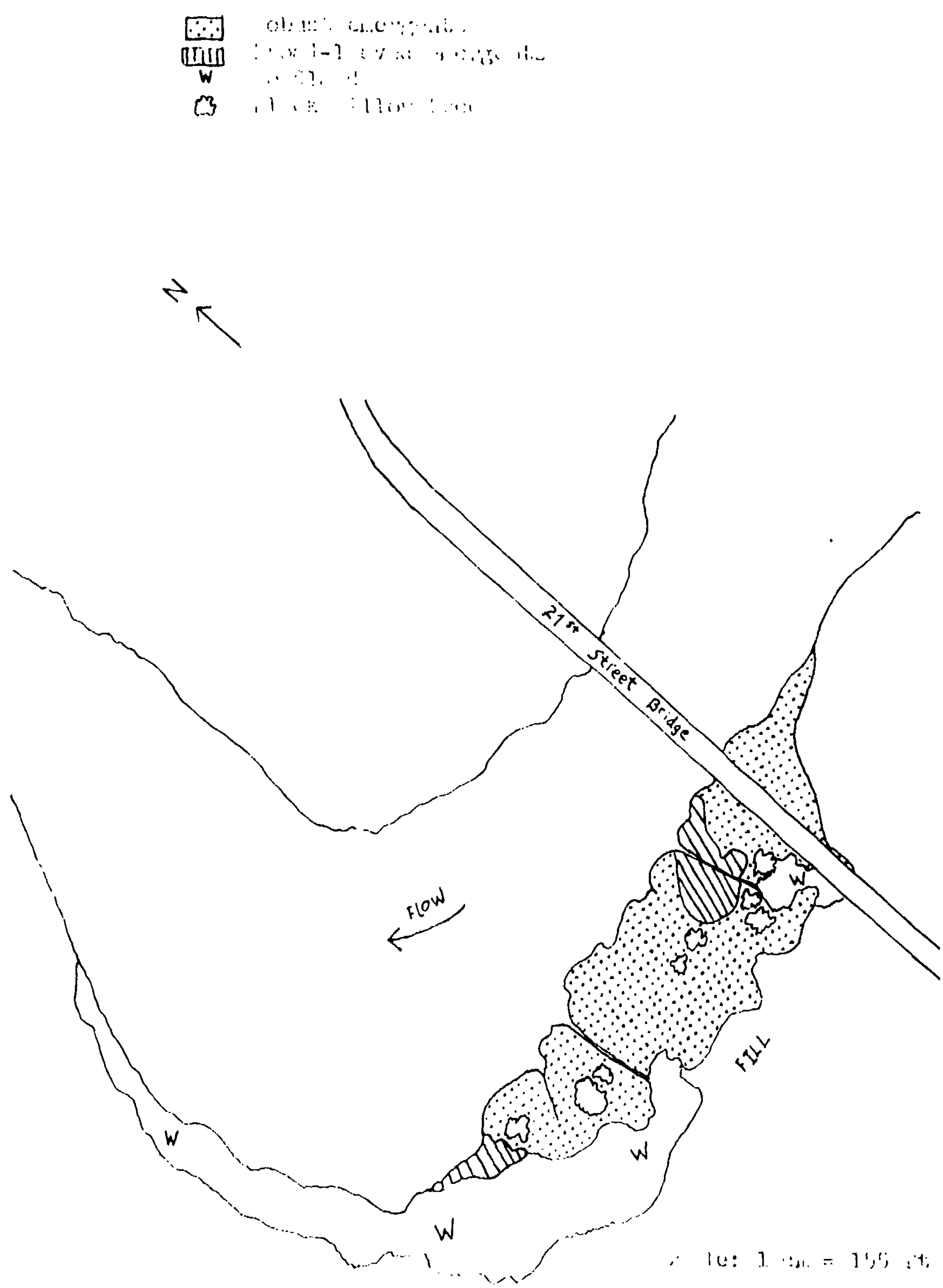

Figure 1 Vegetation map of the wetland on the south side

PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS
ON

LORAIN HARBOR
OHIO

APPENDIX E
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GEOTECHNICAL

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LORAIN HARBOR, OHIO

PRELIMINARY FEASIBILITY REPORT

APPENDIX E

GEOTECHNICAL

E1. REGIONAL GEOLOGY

E1.1 Physiography

Lorain Harbor is at the mouth of the Black River at Lorain, OH. The Black River drains a portion of the Central Lowlands Physiographic Province. This is an area characterized by a flat lying lake plain crossed by sandy ridges of former glacial lakes and by gently rolling moraines. The greatest relief occurs along the Lake Erie shoreline where bluffs rise 30 to 50 feet, and in the major stream valleys.

E1.2 Bedrock Geology

Bedrock in the region consists of Paleozoic shale, siltstone, sandstone, and carbonate rock. In western Ohio, there is a broad low dome known as the Cincinnati Arch which has a north trending axis. The rocks in the vicinity of the structure have a gentle southeastward dip of about 20 feet per mile.

E1.3 Surficial Geology

Unconsolidated material consists of glacial till, glaciofluvial and lacustrine deposits, and alluvium. Much of this material was deposited during the Late Pleistocene.

E2. LOCAL GEOLOGY

E2.1 Bedrock Geology

Bedrock is exposed throughout most of the Black River Valley. From Elyria downstream, the Devonian Cleveland Shale is exposed. When freshly exposed it is bluish black to brownish black and turns coffee brown upon weathering. In fresh exposures, the shale is very compact and massive to platey but after slight weathering it becomes thinly laminated, fissle, and brittle. Upon extreme weathering it turns dark gray and breaks down into flakey pieces but does not acquire the real plasticity of a clay shale. Primary and secondary deposits of pyrite are present in considerable quantities along the laminae as concretionary masses or as finely disseminated pyrite. When the shale is chipped it gives off a gaseous odor. Borings taken in the Lorain Harbor vicinity show that usually the upper 10 feet of rock is weathered and that some vertical jointing is evident.

Upstream of Elyria are rocks of Mississippian Age. The oldest of these is the Bedford shale. This is a grayish to dusky red shale with abundant gray

shale or sandstone and siltstone lenses. The shale weathers rapidly to a sticky red mud and forms outcrops that are obscured by slumping and soil creep.

E2.2 Surficial Geology

The unconsolidated deposits of the Black River Basin consist mostly of till. Goldthwart and others (1965) characterize till in this area as brown clay till. Overlying the till in many areas is a lacustrine clayey silt and sandy beach ridges. These ridges are conspicuous remnants of former glacial lakes. Forsyth (1959) has identified the major ridges as those of Lakes Lundy, Wayne, Warren, Whittlesey, and Maumee I, II, and III.

Alluvial sand and gravel deposits are not as common in the Black River as in other Ohio streams. Most of the alluvium is found in the lower reaches and in the headwaters of its tributaries where the stream cuts through gravelly morainal deposits.

Borings taken by others in the lower reach of the river at Lorain show the soil to consist of alluvial clays with low plasticity and containing traces of sand and organic matter. This is underlain by a dense, silty gravel which directly overlies rock.

E3. FLUVIAL PROCESSES

Most of the Black River and its two major tributaries, the East and West Branches, is incised in bedrock. Most of the other tributaries are short and join the Main, East, and West Branches at relatively steep junctions. Much of the soil in the drainage basin except for the beach ridges have some cohesion and are not easily eroded. Evidence of severe bank and bed erosion is absent. The area of greatest bank erosion occurs in the tributary area upstream of Grafton, OH, where the stream cuts through gravelly morainal hills.

The USGS in 1978 compiled sediment data collected intermittently at the Elyria gage. Their data provide some interesting information into the sedimentological behavior of the stream.

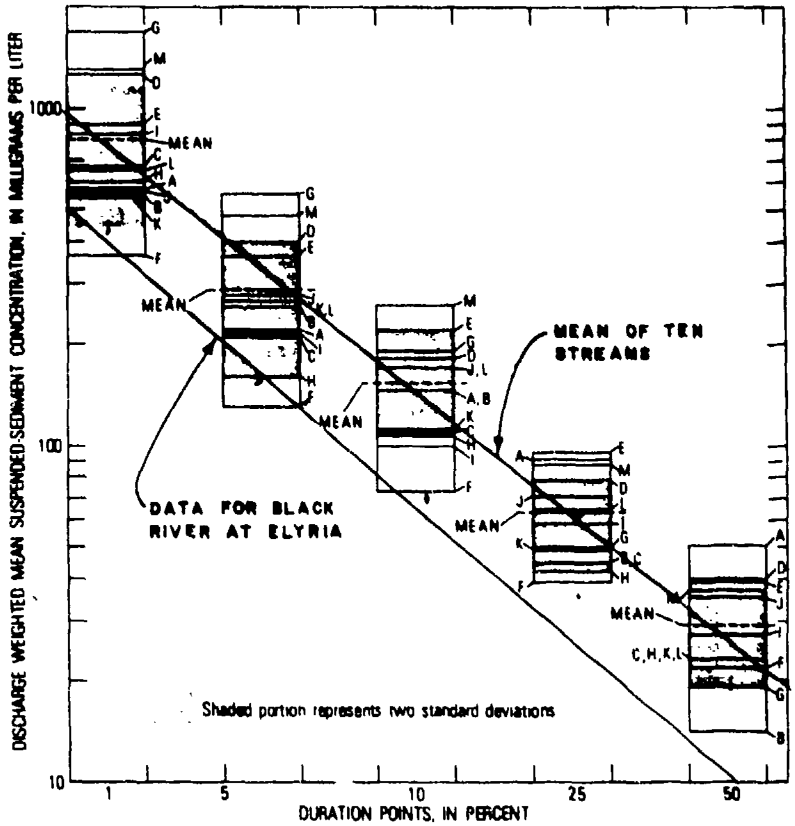
a. There is less than 1 percent bedload discharge in terms of annual suspended load discharge.

b. Seventy-five percent of the sediment discharged is clay.

c. Sediment discharge at Elyria is about 84,000 tons/year.

d. Sediment concentration is considerably lower than the mean of 10 other Ohio streams (Figure 1).

e. The suspended sediment transport curve is steep at low discharges (Figure 2) indicating that soil is rapidly entrained.



EXPLANATION

Symbol	Station No	Location
A	03139000	Killbuck Creek at Killbuck
B	03159500	Hocking River at Athens
C	03229000	Alum Creek at Columbus
D	03234000	Paint Creek near Bourneville
E	03234500	Scioto River at Higby
F	03240000	Little Miami River near Oldtown
G	03244000	Todd Fork near Roachester
H	03265000	Stillwater River at Pleasant Hill
I	03267800	Mad River at Eagle City
J	04193500	Maumee River at Waterville
K	04195500	Portage River at Woodville
L	04198000	Sandusky River near Fremont
M	04208000	Cuyahoga River at Independence

FIGURE 1.—Discharge-weighted mean sediment concentrations at selected duration points.

SOURC' .NTILLA, P.W. AND TOBIN, R.L., 1978, FLUVIAL SEDIMENT IN OHIO U.S.G.S. WATER SUPPLY PAPER 2046

FIGURE B1

SUSPENDED-SEDIMENT DISCHARGE

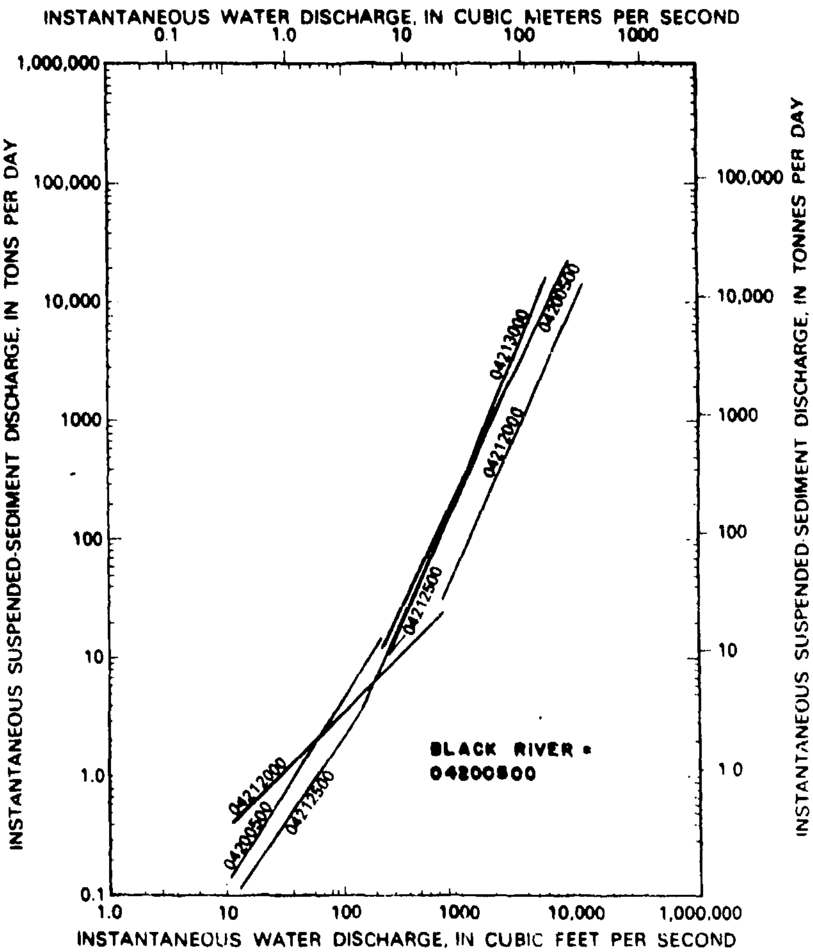


FIGURE 2. —Instantaneous suspended-sediment transport curves for inventory network stations on streams tributary to Lake Erie from and including the Black River to Conneaut Creek.

SOURCE: ANTILLA, P.W. AND TOBIN, R.L.,
1978, FLUVIAL SEDIMENT IN OHIO
U.S.G.S. WATER SUPPLY PAPER 2045

These data show that sediment transport is probably more dependent on the availability of sediment rather than on the hydraulic characteristics of the stream. In such a case, sheet erosion from diffuse areas is a primary source of material, as there is little material to be stored in the stream to be reentrained at a later time.

The table below shows the volume of material dredged at Lorain Harbor. The decline in recent years is probably the result of decreases in industrial discharge.

Sedimentation within the harbor appears to be greatest in the vicinity of the upper turning basins. This can be observed by a noticable decrease in turbidity downstream of the basin. Much of the banks in the harbor are composed of bedrock, however, there are some areas of erosion, especially in the vicinity of stockpiles of sand, slag, and other materials along the bank.

Summary of Historical Dredging at Lorain, Ohio

Year	Hauled Volume in Cubic Yards
1979	192,048
1978	-
1977	30,420
1976	42,290
1975	136,298
1974	498,586
1973	83,922
1972	143,598
1971	136,021
1970	189,414
1969	142,456
1968	230,857
1967	106,713
1966	546,444
1965	87,210
1964	201,131
1963	-
1962	312,422
1961	161,202
1960	234,458
1959	345,655
1958	196,567
1957	251,808
1956	219,701
1955	193,456
1954	146,167

E4. BOTTOM SEDIMENT ANALYSIS

A bottom sediment sampling program was conducted during September 1979 in the Lorain navigation channel. Thirteen bottom sediment samples were obtained using Ponar dredge sampler. Locations of samples are shown in Figure 3.

Laboratory analysis of bottom sediment samples was performed to determine (1) the physical characteristics of the sediment, (2) nature of some pollution parameters in the sediment, and (3) the probable sources of channel sediments requiring annual maintenance dredging.

E4.1 Physical Characteristics of the Sediments

The grain size distribution of each collected sample was determined by laboratory analysis. The grain size distributions are summarized on Table 1a. In general, the sediment samples are fine grained with a large percentage passing the No. 200 sieve. There is no apparent trend towards decreasing grain size in a downstream direction.

E4.2 Nature of Pollution

The U. S. Environmental Protection Agency (USEPA), under their Harbor Sediment Sampling Program, tested sediment samples from the Lorain navigation channel in 1975. The results of testing indicated the sediment dredged from the navigation channel is polluted and unsuitable for open-lake disposal.

As part of the present study of bottom sediments, the two pollutant parameters, oil and grease, and volitile solids were analyzed for in the laboratory. Test results are summarized on Table 1b. The test results indicate an overall decrease in each of the two pollutants from the 1975 USEPA values.

E4.3 Source of the Sediments

Petrographic examination of 6 of the 13 sediment samples was performed to distinguish between material sediments derived from streambank/upland erosion and artificially introduced sediments. Artificially introduced sediments are defined for purposes of this examination as those sediments not normally present in nonpolluted river sediments, and which are the products of industrial processes along the banks of the Black River. The results of the petrographic analyses are summarized on Table 1e through 1h. The test results indicate that the samples examined are predominantly natural sediment with only minor amounts of introduced material (0.25 percent to 6.7 percent).

The introduced sediment constituents consist of opaque metallic minerals (iron, chromium and titanium oxides), fly ash, slag, and glass. Opaque materials were found to predominate introduced materials in all samples and consisted of two types. One is anhedral structureless material of uncertain origin. The second type consists of grains exhibiting well developed cubic and/or octahedral crystal faces. Possible compositions are those of magnetite, ilmenite, chromite and spinel. These materials are interpreted to be a product of industrial processes, although it is possible that some of the opaque material may consist of transported naturally occuring metallic minerals.

Fly ash present in the samples also consists of two types. The first type is spherical, opaque or semiopaque fly ash and the second in an aggregate of such grains. Aggregates of fly ash particles usually contain individual

grains of widely varying size. Most of the naturally occurring sediments in certain sieve sizes contain minute amounts of fly ash in available pore spaces. Minute fly ash particles can also be found adhering to particle surfaces due to an electrical change buildup on the individual fly ash particles.

Glass and slag were both found to occur in trace amounts and represent only minor constituents of the introduced sediment fraction. Either may be present in certain sieve sizes, but glass is slightly more predominant in the samples than slag.

From an analysis of the test results, a trend toward increasing concentration of introduced sediments with decreasing grain size is quite apparent. Maximum concentrations of introduced sediments usually, though not always, occurs in the No. 325 and No. 400 sieve sizes. For those samples having a significant portion passing the No. 400 sieve, the true percent of introduced sedimnent of the entire sample is most likely somewhat greater than the test results indicate.

Table E1 - Gradation Analysis
Total Percent Finer

Sieve Size	Sample Number 1A	1B	2	3	4	5	6	7	8	9	10	11	12
3 in.													
2						100							
1-1/2						93.34		100				100	
1						92.27		92.45				89.86	
3/4						84.41		89.55				87.74	
1/2						64.08		79.69				81.89	
3/8						50.41		72.38				77.11	
No. 3		100	100		100	-		-		100	100		100
4	100	78.99	99.11	100	52.05	25.99	100	57.76	100	98.87	98.86	66.66	99.13
6						-		-				-	
8						16.38		48.48				57.95	
12						-		-				-	
16						10.92		40.19				47.29	
20						-		-				-	
30						8.09		35.29				37.01	
40						7.43		32.89				31.59	
50						6.97		28.69				26.73	
70						6.64		23.13				23.11	
100						6.30		18.38				20.87	
140						6.02		11.86				18.09	
200	98.88	64.70	69.88	91.35	46.40	5.75	94.72	9.65	89.53	83.86	86.92	16.48	90.30

Table E2 - Analysis for Oil and Grease and Volitile Solids

Sample Number	Percent Oil and Grease	Percent Volitile Solids
1A	.7	9.8
1B	2.7	7.8
2	1.8	6.4
3	1.3	7.5
4	.1	6.6
5	0.1	4.3
6	.7	6.4
7	0.1	3.2
8	.7	6.8
9	.7	5.7
10	.3	5.6
12	.6	6.7

TABLE E3

Petrographic Examination Report
Sample #1A

Sieve Size	% -4 Size Fraction	% Total Sample	% Natural Sediments In Sieve Size	% Introduced Sediments In Sieve Size: Fly ash, Slag, etc.	% Introduced Sediments In -4 Size Fraction	Introduced Sediments, % Of Total Sample	BLACK RIVER #1A
							op = opaque materia
#200		38.3	100.0	-	-	-	f = fly ash
#235		17.7	100.0	-	-	-	s = slag and/or glass
#270		14.2	95.7	4.3 op, f, s	→	0.62	
#325		17.3	98.2	1.8 op, f, s	→	0.32	Symbols after % are given in decreasing order of abundance.
#400		12.5	96.4	3.6 op, f, s	→	0.45	
						1.39 = 1.4%	

TABLE E4

Petrographic Examination Report
Sample #3

Sieve Size	% -4 Size Fraction	% Total Sample	% Natural Sediments In Sieve Size	% Introduced Sediments In Sieve Size: Fly ash, Slag, etc.	% Introduced Sediments In -4 Size Fraction	Introduced Sediments, % Of Total Sample	BLACK RIVER #3
							op = opaque material
#200		29.4	97.7	2.3 op, f	→	0.69	f = fly ash
#230		18.4	95.7	4.3 op, s	→	0.80	s = slag and/or glass
#270		17.5	90.6	9.4 op, s	→	1.54	
#325		20.8	90.4	9.6 op, s, f	→	2.00	Symbols after % are given in decreasing order of abundance.
#400		13.9	88.9	11.1 op, s, f	→	1.54	
						6.67 = 6.7%	

TABLE E5

Petrographic Examination Report
Sample #5

Sieve Size	% -4 Size Fraction	% Total Sample	% Natural Sediments In Sieve Size	% Introduced Sediments In Sieve Size: Fly ash, Slag, etc.	% Introduced Sediments In -4 Size Fraction	Introduced Sediments, % Of Total Sample
#8	34.2	8.9	100.0	-	-	-
#16	19.4	5.0	100.0	-	-	-
#30	10.1	2.7	100.0	-	-	-
#50	4.0	1.0	100.0	-	-	-
#100	2.4	0.6	100.0	-	-	-
#200	1.9	0.5	99.0	1.0 op	0.02	0.005 (tr)
#230	6.5	1.7	98.3	1.3 op	0.08	0.02
#270	7.4	1.9	95.5	4.5 op	0.33	0.09
#325	8.8	2.3	96.8	3.2 op, f	0.28	0.07
#400	5.3	1.4	95.0	5.0 op	0.26	0.07
	28.0	7.3			0.98 = 1%	0.25%

BLACK RIVER #5

op = opaque material

f = fly ash

s = slag and/or glass

Symbols after % are given in decreasing order of abundance.

TABLE E6

Petrographic Examination Report
Sample #7

Sieve Size	% -4 Size Fraction		% Total Sample		% Natural Sediments In Sieve Size	% Introduced Sediments In Sieve Size: Fly ash, Slag, etc.	% Introduced Sediments In -4 Size Fraction	Introduced Sediments, % Of Total Sample	BLACK RIVER #7
#8	15.8		9.1		100.0	-	-	-	op = opaque material
#16	14.0		8.1		100.0	-	-	-	f = fly ash
#30	8.3		4.8		100.0	-	-	-	s = slag and/or glass
#50	4.1		2.4		99.0	1.0 op, s	0.04	0.02	Symbols after % are given in decreasing order of abundance.
#100	24.6		14.2		98.0	2.0 op, s	0.49	0.28	
#200	14.8		8.6		91.0	9.0 op, s, f	1.33	0.77	
#230	5.8	18.4	3.4	10.6	63.7	36.3 f	2.11	1.23	
#270	5.1		2.9		94.5	5.5 op, f	0.28	0.16	
#325	5.1		2.9		89.5	10.5 op, f	0.53	0.30	
#400	2.4		1.4		90.0	10.0 op, f	0.24	0.14	
							5.02 = 5%	2.9%	

TABLE E7

Petrographic Examination Report
Sample #9

Sieve Size	% -4 Size Fraction	% Total Sample	% Natural Sediments In Sieve Size	% Introduced Sediments In Sieve Size: Fly ash, Slag, etc.	% Introduced Sediments In -4 Size Fraction	Introduced Sediments, % Of Total Sample	BLACK RIVER #9
							op = opaque material
#8		9.3	100.0	-	-	-	f = fly ash
#16		3.2	100.0	-	-	-	s = slag and/or glass
#30		1.4 } 16.1	100.0	-	-	-	
#50		0.9	100.0	-	-	-	Symbols after % are given in decreasing order of abundance.
#100		0.6	100.0	-	-	-	
#200		0.6	95.2 op	4.8 op, f	→	.03	
#230		20.1	93.3	6.7 op, f, s	→	1.34	
#270		18.5 } 83.9	95.1	4.9 op, f	→	0.91	
#325		24.2	93.2	6.8 op, f	→	1.66	
#400		24.1	91.7	8.3 op, f	→	1.74	
						5.68 = 5.7%	

TABLE E8

Petrographic Examination Report
Sample #11

Sieve Size	% -4 Size Fraction		% Total Sample		% Natural Sediments In Sieve Size	% Introduced Sediments In Sieve Size: Fly ash, Slag, etc.	% Introduced Sediments In -4 Size Fraction	Introduced Sediments, % Of Total Sample	BLACK RIVER #11
#8	12.9	74.2	8.6	49.5	99.0	1.0 op	0.13	0.09	op = opaque material
#16	15.7		10.5		99.7	0.3 op	0.52	0.35	f = fly ash
#30	15.2		10.1		99.3	0.7 op	0.11	0.07	s = slag and/or glass
#50	15.2		10.1		100.0	-	-	-	Symbols after % are given in decreasing order of abundance.
#100	8.7		5.9		98.7	1.3 op	0.11	0.08	
#200	6.5		4.3		96.6	3.4 op, f	0.22	0.14	
#230	6.6	25.8	4.4	17.2	93.0	7.0 op, f	0.43	0.29	
#270	6.2		4.1		97.2	2.8 op, f	0.17	0.11	
#325	6.6		4.4		94.6	5.4 op, f	0.35	0.24	
#400	6.4		4.3		96.8	3.2 op, f, s	0.21	0.14	
							2.35 = 2.4%	1.51 = 1.5%	

PRELIMINARY FEASIBILITY REPORT
(STAGE 2)

REVIEW OF REPORTS
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APPENDIX F
CORRESPONDENCE

APPENDIX F

CORRESPONDENCE

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LORAIN PORT AUTHORITY

JOHN G. SULPIZIO
EXECUTIVE DIRECTOR
ROOM 511 . CITY HALL
LORAIN, OHIO 44052
PHONE 216/244-2269

May 13, 1981

Colonel George P. Johnson, District Engineer
U. S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Robert Webster

Dear Bob:

At the April 7, 1981 workshop conducted by the Corps in Lorain regarding navigation improvements to the Black River, Lorain, Ohio, the Lorain Port Authority agreed to formulate a consensus of opinion of maritime interests on the subject of limiting study alternatives. In previous correspondence, I sent to you our written solicitation of opinion. Since that date, I have had numerous conversations and have received the enclosed replies to my inquiries.

The Board of Directors of the Lorain Port Authority considered the matter at their regular meeting on April 14, 1981, and again, on May 12, 1981. At this second meeting, the recommendation of port users was evaluated and the Board of Directors passed the following motion:

> "that the Corps of Engineers should immediately proceed in their study of a Lakefront Terminal in the old coal slip, analyze further the Riverside cut (noting particularly the large support for it), and to research in more depth the conveying of commodities upstream and the shuttling via special purpose vessels to upstream locations."

Of course, Bob, this motion is intended to include outer breakwater improvements, the potential for a new terminal location immediately upstream of the Bascule Bridge, and marina development. The Board further stressed the need for the Corps to collaborate with the County Engineer to fully understand the condition and status of the Bascule Bridge as it may bear upon the continuing study effort. Additional comments encouraged

the Corps to expedite the planning process in every possible way, and the Board pledged its cooperation in doing so.

This motion and the policy position of the Board constitutes an acceptance of your recommendation presented at the April 7th workshop. I trust this local participation process has assisted you in your study program. Please feel encouraged to call me should further information be required. As always, I send my best regards.

Sincerely,

JGSulpizio

John G. Sulpizio
Executive Director

JGS:rw
enclosure

The Interlake Steamship Company
1100 Superior Avenue
Cleveland, Ohio 44114

May 11, 1981

John G. Sulpizio
LORAIN PORT AUTHORITY
Room 511
City Hall
Lorain, OH 44052

Robert Webster
Study Manager
Buffalo District
CORPS OF ENGINEERS
1776 Niagara Street
Buffalo, NY 14207

RE: LORAIN HARBOR COMMERCIAL NAVIGATION STUDY

Gentlemen:

Pickands Mather & Co. operates The Interlake Steamship Company and carries the Republic Steel Corp. iron ore to the Lorain Pellet Terminal. This movement was introduced in 1980 during the course of which considerable delay was encountered by reason of other ships, inbound and outbound, passing in the Black River en route to the up-river U.S. Steel and other dock property.

In 1981 this delay will become compounded with deliveries to Lorain Pellet Terminal being four times what they were in 1980. In addition, the ship loader at Lorain Pellet Terminal has become operational this year and will be loading out an expected 160 - plus cargoes. We know that the unloading and loading ships will interfere with one another, but when the ships bound for up-river docks are added to the picture, the whole delay situation will be severe for all. This delay will be tabulated and expressed in money as experience is gained.

For these reasons we feel that the Riverside Park Cut is the best solution to the problem in order to eliminate the majority of passing situations in the existing Black River. The Riverside Cut would be more nearly at right angles to the Erie Avenue Bridge, and could be built to allow ships carrying 25,000 G.T. or more to get all the way up the river to their destination. This then precludes the necessity of having a transshipment dock at any point and eliminates the concern of how to transport material from it.

Exhibit F-2

Certainly the concept of a Black River shuttle vessel in view of the present congestion in the river holds no promise. We also feel that the cost-benefit ratio of the Riverside Park Cut plan cannot be accurately quantified until more experience is gained from the loading, unloading, and passing situations that are now beginning to take place.

Very truly yours,

THE INTERLAKE STEAMSHIP COMPANY

D. P. Aston

D. P. Aston
Manager of Operations

DPA/jk

United States Steel Corporation
EASTERN STEEL DIVISION
LORAIN-CUYAHOGA WORKS
1807 EAST 28TH STREET
LORAIN, OHIO 44055

D. H. PASS
GENERAL SUPERINTENDENT

April 22, 1981

Mr. John G. Sulpizio
Executive Director
Lorain Port Authority
Room 511 - City Hall
Lorain, Ohio 44052

Dear John:

I am sure you realize that both David Van Brunt of Lake Shipping and we at the Lorain Plant are strongly in favor of the Riverside Park cut as the most important first step in improving navigation in the Black River.

We also agree with the Corps of Engineers' proposal that a storage/reclaim area across the river from AmShip could be supplied by conveyor transshipment from the lakefront or, preferably, by offloading 1000 foot vessels at the site.

In response to your request for our preference of the four modes of moving bulk material upstream from the proposed storage area to our dock, we can easily designate the special purpose shuttle vessel as the most desirable. We have little enthusiasm for the other methods.

We hope these comments will assist you in communicating the private sector input to the Corps of Engineers.

Yours truly,

General Superintendent

cc: D. G. Van Brunt

Exhibit F-3

DIVISION

THE AMERICAN SHIP BUILDING COMPANY
400 COLORADO AVENUE • LORAIN, OHIO 44052

EXECUTIVE OFFICES

May 12, 1981

Mr. John G. Sulpizio
Executive Director
Lorain Port Authority
Room 511 - City Hall
Lorain, Ohio 44052

Dear John:

The AmShip Division of The American Ship Building Company strongly supports the "Riverside Cut" alternative for improvements to the Black River. As you know, launching and docking of 1,000 Ft. Vessels and their passing through the existing bridge opening is a cautious endeavor. The "Riverside Cut" alternative, as we understand it, would give such vessels a straighter approach in and out of our facility. We at AmShip feel that this improvement would certainly enhance our facility in the eyes of our customers.

Gavin Sproul, our Vice President of Engineering, made the following evaluation.

Bridge opening at pilothouse level with a vessel at 20' draft:

Existing opening parallel to channel	=	137.5'
"Rockside Cut" opening parallel to bridge	=	223.5'

Clearance gained 86.0' or 62% gain in clearance.

The development of a lake-front terminal at the old coal slip and the mode of upstream movement are subjects that AmShip has no expertise in; therefore, we feel comment at this time is not necessary.

John, we appreciate your soliciting our opinion in this matter and will look forward to supplying any further information that may be needed.

Very truly yours,

AMSHIP DIVISION of
The American Ship Building Company

William Meldrum

William Meldrum
General Manager

WM/pg

cc: G. Sproul
G. Stafford

Exhibit F-4

LPT

Lorain Pellet Terminal Company
203 North Broadway
Lorain OH 44052
Tel 216/244-2324

May 5, 1981

Mr. John G. Sulpizio
Director
Lorain Port Authority
City Hall, Room 511
Lorain, Ohio 44052

Dear John:

In answer to your request regarding preferred alternatives for improvement to the Black River and harbor, we recommend the Riverside Park cut be made to improve vessel approach to the Erie Avenue Bridge as well as alleviate the congestion problem in the downstream portion of the river.

Also, we feel outer harbor modifications, including removal of 600 feet of the East breakwater and a 600 foot addition to the outer detached breakwater are justified and should be seriously considered due to the ever-increasing number of 1000' vessels which will be utilizing the river and harbor.

Very truly yours,

Joseph F. Jenkins

Joseph F. Jenkins
General Manager

JFJ
jmk

cc: A. A. Apotsos
P. A. Manley

Exhibit F-5

Big is bountiful

The history of Great Lakes bulk carriers is a history of continual growth in size. In 1900 the largest ore carrier on the Lakes had a deadweight capacity of about 9000 long tons. Today we have ships of 61,000 tons capacity. Although the difference is large, it represents a modest exponential growth rate of less than 2.5 percent per annum.

The history of bigger ships is also the history of bigger public investments in canals, locks and harbors. Shipowners have been quick to exploit every increase in ship size allowed by each successive improvement in the navigable waters of the Great Lakes. They have done this because they can find no better way to lower the costs of transport. Thus, the taxpayer who has provided the money for the bigger locks and deeper channels has found his investment repaid in the form of a more bountiful supply of low-priced consumer goods.

Why are bigger ships more economical? The reasons are many. The invested cost per unit of transport capacity decreases with size, as does the energy required. The crew size and wages on a 60,000-ton ship need be no greater than those on a 10,000-ton ship.

Bigger ships mean safer ships, too. Since fewer are needed to do the job, the potential for collisions is reduced; owners, moreover, need dip less deep into the barrel of talent in selecting officers and crew.

Too much of a good thing? But, we can have too much of a good thing, and so we must ask ourselves periodically how much further we ought to go in making such investments. Timing is important here for two reasons. First, what may be technically infeasible today may be reasonably easy tomorrow. Second, federal agencies responsible for public works, notably the Corps of Engineers, find themselves unable to move ahead expeditiously even after years of cautious study. Thus, decisions to effect improvements must be based on forecasts of commercial needs and engineering capabilities at least a decade in the future. No easy task, that.

Any discussion of bigger ships involves questions of dredging, and questions of dredging bring down upon the Corps the wrath of the environmentalists. Some of their concerns are legitimate and deserve attention. Others are truly far-fetched rationalizations for defending the status quo. Unfortunately, our political leaders are ill-equipped to tell one from the other.

And so the Corps is forced to accord exaggerated importance to environmental concerns. As one objective observer remarked (we hope facetiously), "For every cubic yard of mud dredged up, the Corps must submit a cubic yard of environmental impact statement. The question then arises, how does EPA dispose of all that paper? And what of the environmental effects of chopping down all those trees to produce the paper in the first place?"

Some four years ago the Chicago office of the Corps of Engineers started a major study of costs and benefits of allowing larger ships to operate on the Great Lakes and through the St. Lawrence Seaway. Some of my colleagues and I were asked to help. Our role was to estimate the benefits, while the Corps was to estimate the costs.

We were asked to consider ships ranging in size up to 1500 ft. in length, 175 ft. in beam, and with cargo capacities of over 200,000 long tons. If those figures seem extreme, they are. That was done deliberately so that when we finished we should not find we had stopped short of the optimum.

In decades ahead, however, such an extreme size may become economically desirable. Technological developments and economic pressures may make them more attractive, while more mature views on environmental protection may make those hurdles less inhibiting.

Economic benefits. Looking at one ship at a time, a useful measure of economic merit is the required freight rate. This is the hypothetical rate that a shipowner must charge his customer if the owner is to earn a reasonable (say ten percent) after-tax yield on his investment. Minimizing the required freight rate is socially desirable because low freight rates will eventually be reflected in low costs for consumer goods.

Let us look at the required freight rates for today's largest Great Lakes bulk carriers as well as those that could be offered by future ships of greater size. We iden-

Exhibit F-6

Harry Benford

tify these as Ships A, B and C. Ship A is the 1000-ft. by 105-ft. representative of today's maximum permissible size. Ship B is 1300 ft. long and 130 ft. wide. Ship C is 1500 ft. long and 175 ft. wide. All three ships (A, B and C) are assumed to draw the currently allowable 28 ft. of water; this means that the dreding required for the bigger ships would be to widen, rather than deepen, the channels. Fig. 1 shows our estimates of the freight rates required for each of the three ship sizes. As may be noted, the advantages of larger size are not really pronounced when draft remains limited.

In the above comparison we assumed no increase in draft for the bigger ships. A more logical assumption would be that our most cost effective move would be toward some combination of both larger size *and* deeper draft. Let us, then, consider two additional designs. Ship B-1 is the same as Ship B except that its draft is increased from 28 ft. to 32 ft. Ship C-1 is the same as Ship C except that its draft is increased to 36 ft. In Fig. 2 we show our estimates of required freight rates for these two larger, deeper-draft ships compared again to Ship A and to their 28-ft. draft counterparts. The potential gains now become more clearcut.

Our studies examined many more combinations of ship size and draft, but the ones shown here are good representatives.

The designs. Before we could examine the economics of larger ships we had to have some idea of how much they would cost to build and to operate, and how much cargo they could carry. To answer those questions we needed to answer many others such as: how much steel would be needed for the hull structure? How powerful a machinery plant would be required? How many tons of cargo could be carried in a single trip? And so forth.

Technical questions of that nature are not easily answered when applied to ships of unprecedented size. We could have made estimates based on extrapolations of existing ships. A modest extrapolation is usually reliable; but we were looking at ships more than three times as big (in capacity) as any now on the Lakes.

And so we saw the clear need for some conceptual design work on the part of some experienced design firm. We turned, then, to R. A. Stearn, Inc., with a subcontract to block out designs and estimate weights, speed and power, etc., for a large family of ships ranging in size up to the 1500-ft. by 175-ft. limit already explained. Fig. 3 and 4 compare a typical contemporary 1000-ft. design (Ship A) to R. A. Stearn's concept of Ship B (1300 ft. x 130 ft. x 28 ft. draft) and Ship C-1 (1500 ft. x 175 ft. x 36 ft. draft).

Design details. In developing the designs, R. A. Stearn's naval architects envisioned twin-belt self-unloaders with C-type elevating conveyors feeding a simple overside shuttle. Unloading rates range up to 30,000 tons per hour (short tons of coal, long tons of iron ore pellets).

The designs call for a crew of 32, with accommodations and navigation space to be placed close to amidships. This would make the quarters less susceptible to vibrations and to the inevitable dust and dirt that accompany the cargo handling operations. It would also allow better visibility from the bridge. The traditional argument against the midship house is that it interferes with the loading gear. The naval architects recognize this, but argue that these ships would in any case require new loading facilities, which could be designed with that arrangement in mind.

The hull structure would for the most part be of high strength steel, ABS grade AH 36. Most of the framing would be longitudinal, with transverse webs at 8-ft. intervals. The hatches would be of conventional design, spaced 24-ft. center-to-center. In the case of ships with 175-ft. beams, twin hatches are proposed so as to keep the covers of convenient size for handling. This calls for a total of no fewer than 110 hatches in the largest of the designs, and suggests that the time has come to apply new concepts in hatch and hatch cover configuration.

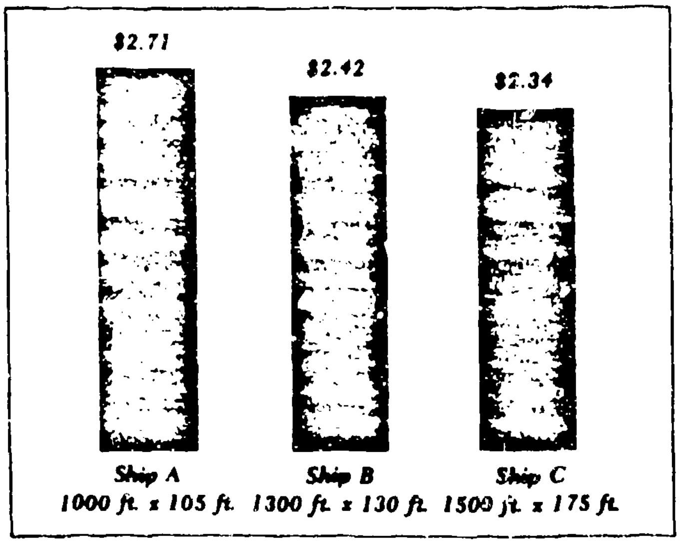


Figure 1: Economic benefit of bigger ships, without benefit of deeper drafts. (Required freight rates are shown in dollars per long ton.)

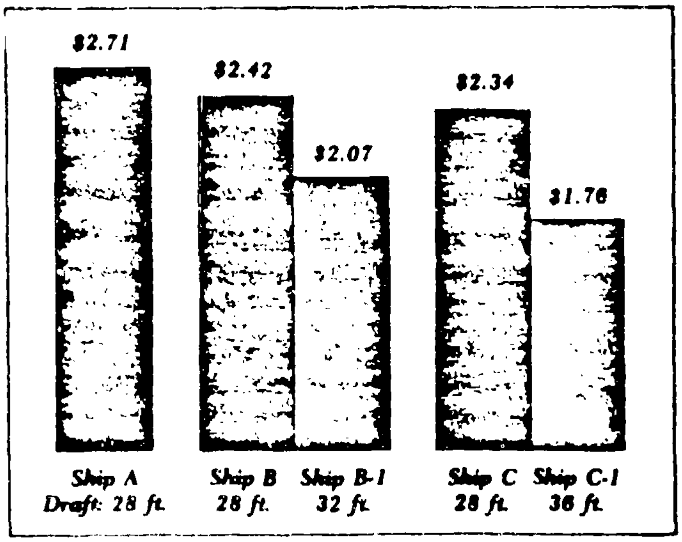
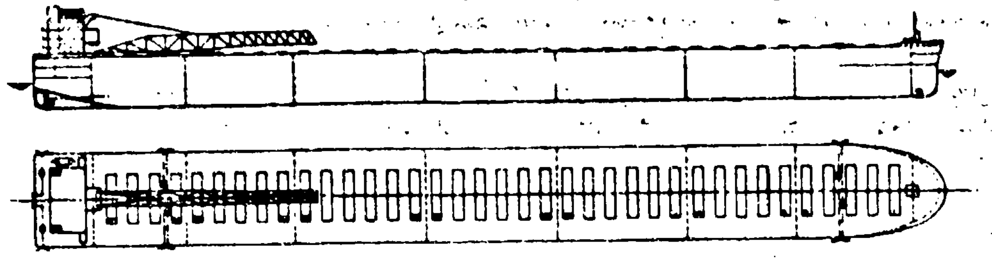
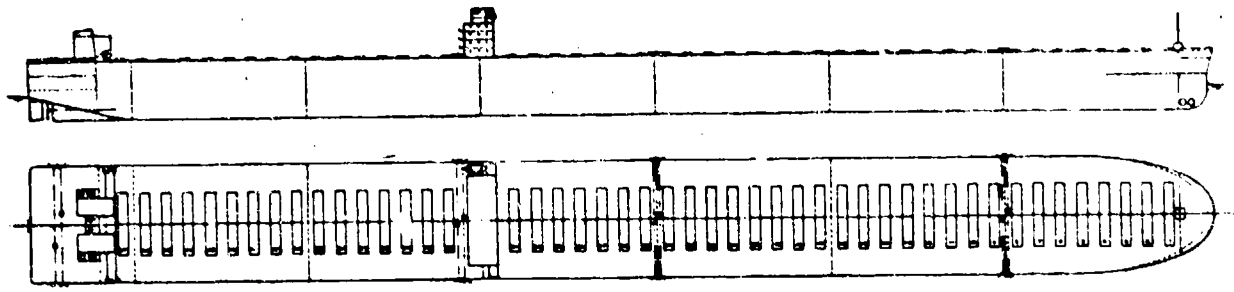


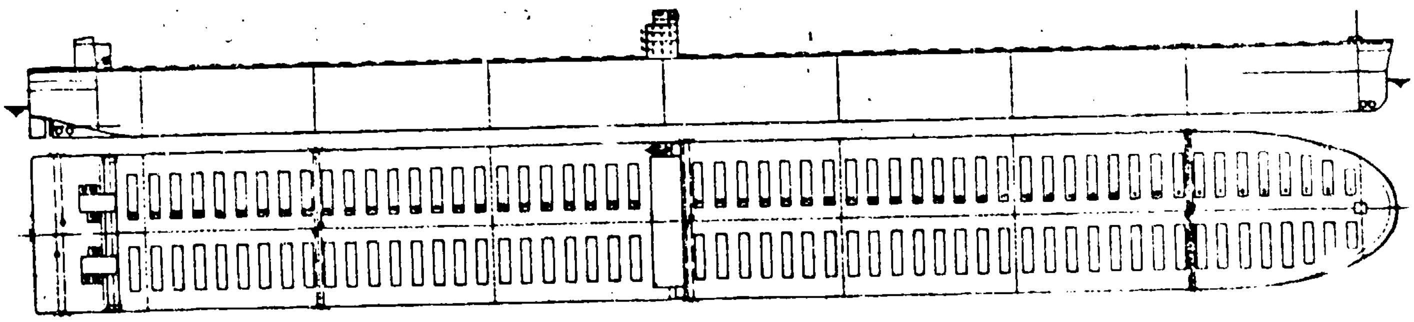
Figure 2: Economic benefit of bigger ships and deeper drafts. (Required freight rates are shown in dollars per long ton.)



Ship A 1000-ft. x 105-ft. x 28 ft. draft



Ship B 1300-ft. x 130-ft. x 28 ft. draft



Ship C-1 1500-ft. x 175-ft. x 36 ft. draft

SCALE OF FEET

0 100 200 300 400

Figure 3: Profiles and Deck Plans

TAYLOR

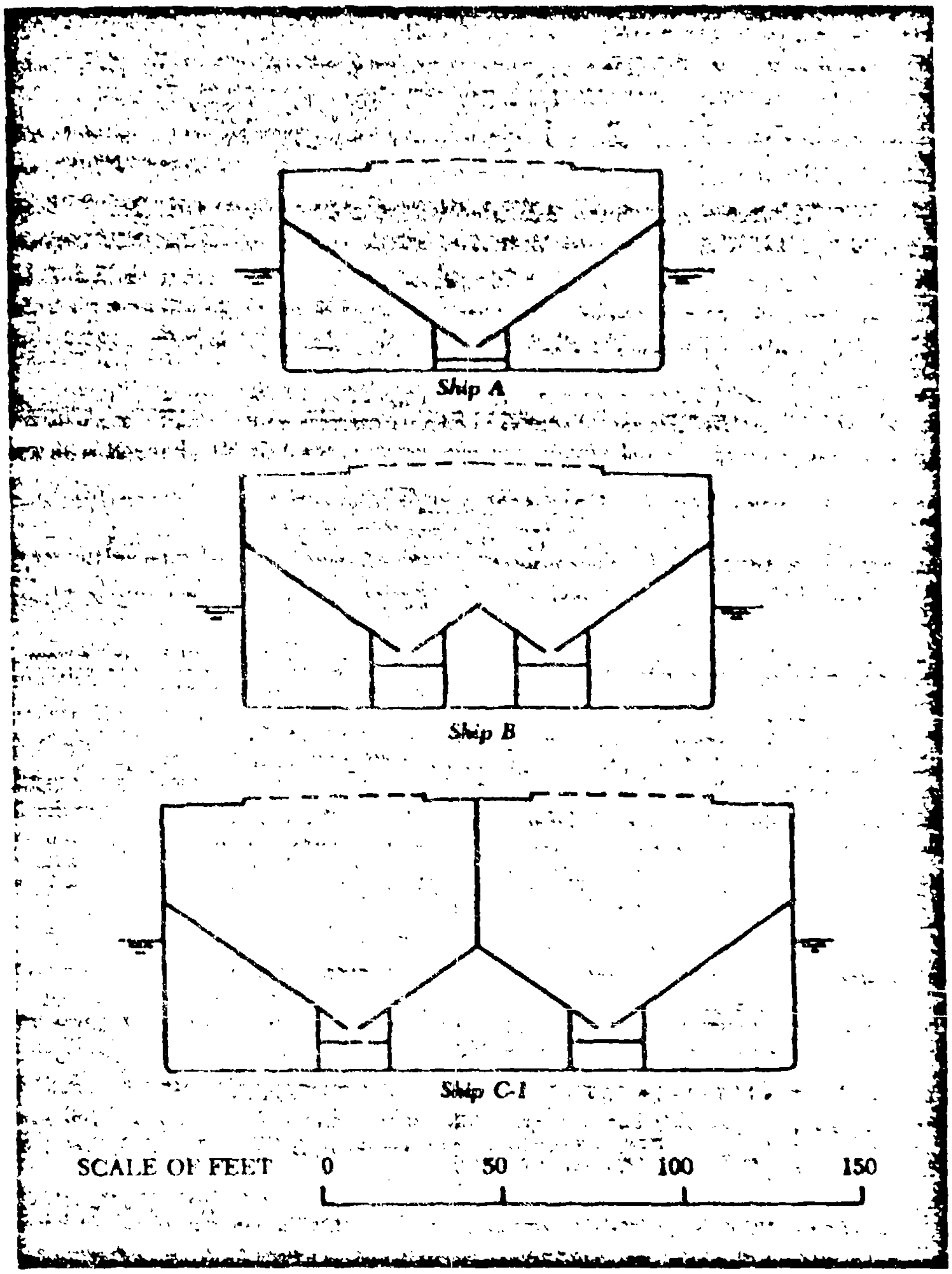


Figure 4: Transverse Sections

Propulsion plants. The designers have arbitrarily selected medium speed diesels for each of the designs, although they recognize that alternatives should not be overlooked. Their proposed engines could burn heavy oil. Shaft horsepowers would range from 8700 (provided by two engines) to nearly 75,000 (six engines), with a shift from twin- to triple-screw at about 40,000 SHP. The possibility of going to quadruple screw was suggested as being worth further study.

In each case, the designers have carefully integrated the arrangement of cargo hold hoppers, conveyors, and propulsion plants. Fig. 5 shows the configuration proposed for Ship C-1, with triple screws and two engines geared to each propeller, producing a total shaft horsepower of 74,300 and a fully loaded speed of 17.4 knots, or 20.0 miles per hour.

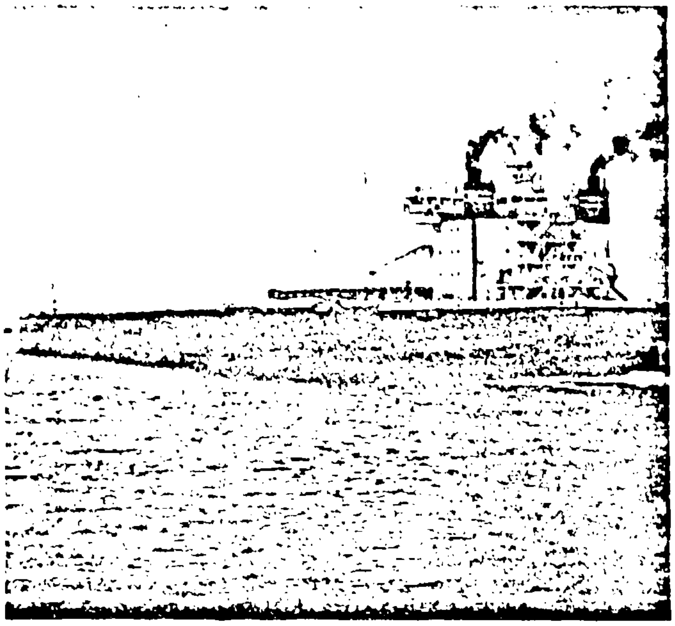
Given the assumptions spelled out above, the designers estimate the cargo deadweights would compare as follows with the 61,000 long tons carried by today's thousand footers:

Ship B (1300 ft. x 130 ft. x 28 ft. draft): 99,000 long tons

Ship B-1 (1300 ft. x 130 ft. x 32 ft. draft): 118,000 long tons

Harry Benford

Typical 1,000-ft. Great Lakes bulk carrier.



Ship C (1500 ft. x 175 ft. x 28 ft. draft): 150,000 long tons

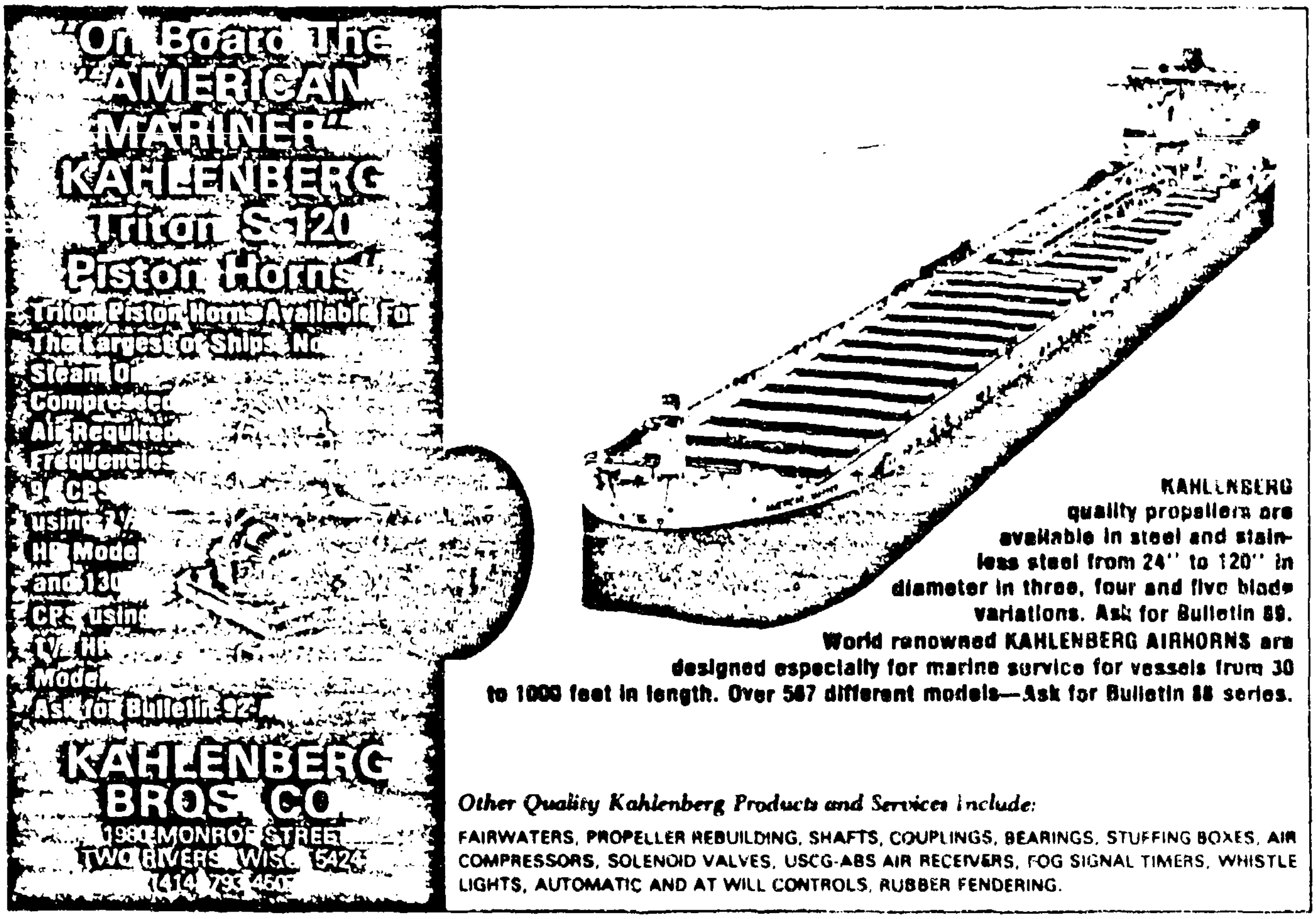
Ship C-1 (1500 ft. x 175 ft. x 36 ft. draft): 206,000 long tons

Areas of ignorance. Before building ships of the sizes envisioned here, any careful naval architect would want to fill many gaps in his current fund of knowledge. Many of R. A. Stearn's assumptions should be carefully studied, many alternatives considered. A lot of money should be put into R & D to ensure maximum returns on investments in larger ships. Perhaps the most fruitful area for research would be to study the economics of ships and channels treated as a single system.

Dredging has become so expensive that we must consider ways to operate ships safely and expeditiously in channels with smaller side clearances and tighter bends. New navigation systems and better maneuvering devices may point the way; but our researchers need time and money to provide the numbers required to optimize the system.

Other obvious R & D needs include hull form studies, structural optimization, and vibration analysis. Selection of cargo handling systems and selection of main propulsion plants also merit careful research.

The other side of the coin. We have considered here only the benefits of bigger ships. There is nothing in this to prove that the gains would be great enough to offset the public costs. That issue is still under study by the Corps of



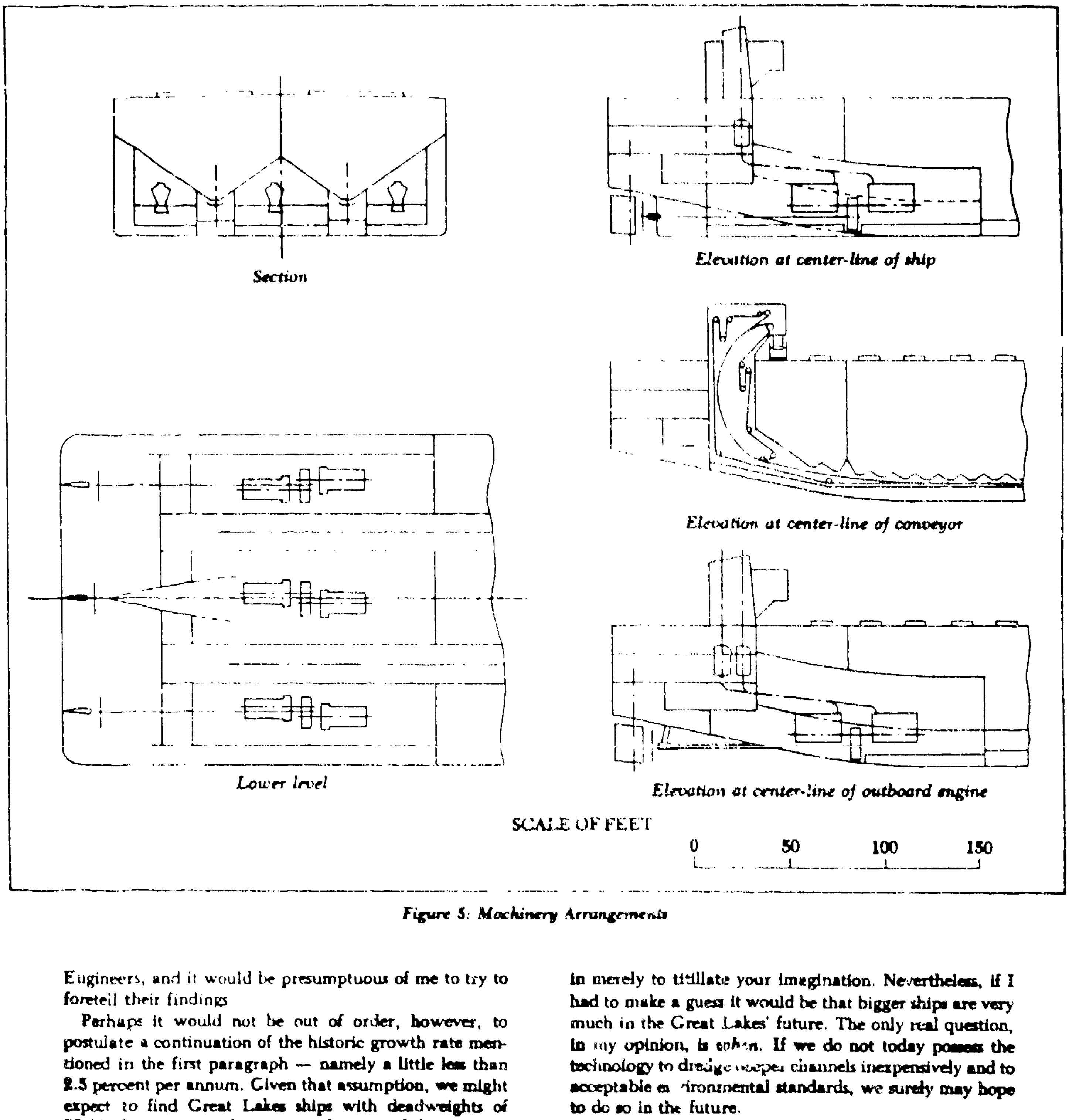


Figure 5: Machinery Arrangements

Engineers, and it would be presumptuous of me to try to foretell their findings

Perhaps it would not be out of order, however, to postulate a continuation of the historic growth rate mentioned in the first paragraph — namely a little less than 2.5 percent per annum. Given that assumption, we might expect to find Great Lakes ships with deadweights of 98,000 long tons on the scene at the turn of the century. Such a size would correspond to the proposed 1300 ft. x 1[illegible]0 ft ship at 28-ft draft (Ship B).

Playing the same game of extrapolating the past into the future we would conclude that we might have to wait until A.D. 2030 to see ships of 206,000 tons — corresponding to the largest size we considered in our study: the 1500 ft. x 175 ft. x 36 ft. draft monster, Ship C-1.

Let me emphasize most emphatically: the immediately preceding postulations are *not* predictions; they are tossed in merely to titillate your imagination. Nevertheless, if I had to make a guess it would be that bigger ships are very much in the Great Lakes' future. The only real question, in my opinion, is when. If we do not today possess the technology to dredge deeper channels inexpensively and to acceptable environmental standards, we surely may hope to do so in the future.

Let our slogan then be Small May Be Beautiful, But Big Is Bountiful. ☐

I want to thank R. A. Stearn for his cooperation in providing several of the drawings used in this article. I also want to thank Major General Richard L. Harris, U.S. Army Corps of Engineers, for permitting me to publish information derived from studies done under contract to the U.S. Army Corps of Engineers, North Central Division.

Republic Steel Corp.'s Lorain Pellet Terminal

New transshipment facility to be in full operation August 1980

by DAVID N. SKILLINGS Jr.

As PART OF A NEW SYSTEM FOR delivery of iron ore pellets to its plants in the Great Lakes region, Republic Steel Corp. is constructing a pellet transshipment terminal at the port of Lorain, Ohio, on Lake Erie, for completion in 1980. The facility is designed to provide the company with the economies resulting from the use of 1000-ft. self-unloaders to carry iron ore pellets from Minnesota and Michigan to its steel works in Cleveland and the Mahoning Valley district.

The major project will commence operation with the arrival of the first cargo of iron ore pellets that is scheduled to arrive at the Lorain pellet terminal about April 1, 1980, followed by the rail loading of pellets for delivery by the Chessie System railroad to Republic's steel works in the Mahoning Valley district to commence on April 15, 1980. By Aug. 1, 1980, the initial vessel cargo of pellets is scheduled to be shipped from the terminal to the company's steel plant in Cleveland.

Presently, Republic is supplied with iron ore pellets by Reserve Mining Co. and Hibbing Taconite Co., both on the Mesabi iron range of Minnesota, in which ownership interests of 50% and 16% are held, respectively, and also purchases pellets produced by Eveleth Mines. In addition, pellets are received from the Groveland mine operated by The Hanna Mining Co. on the Menominee iron range of Michigan, and pellets from The Cleveland-Cliffs Iron Co.'s plants in Michigan. An ownership interest of 6.09% also is held by Republic in Iron Ore Co. of Canada in the Quebec-Labrador region, but this pellet tonnage is shipped mainly to the company's steel works in Gadsden, Ala., and Buffalo, N. Y. Although the terminal will serve principally the Cleveland and Mahoning Valley steel works, Reserve and Hibbing pellets could be transshipped either by railroad or vessel to the Buffalo plant.

TRANSPORTATION CONTRACT WITH P.M.

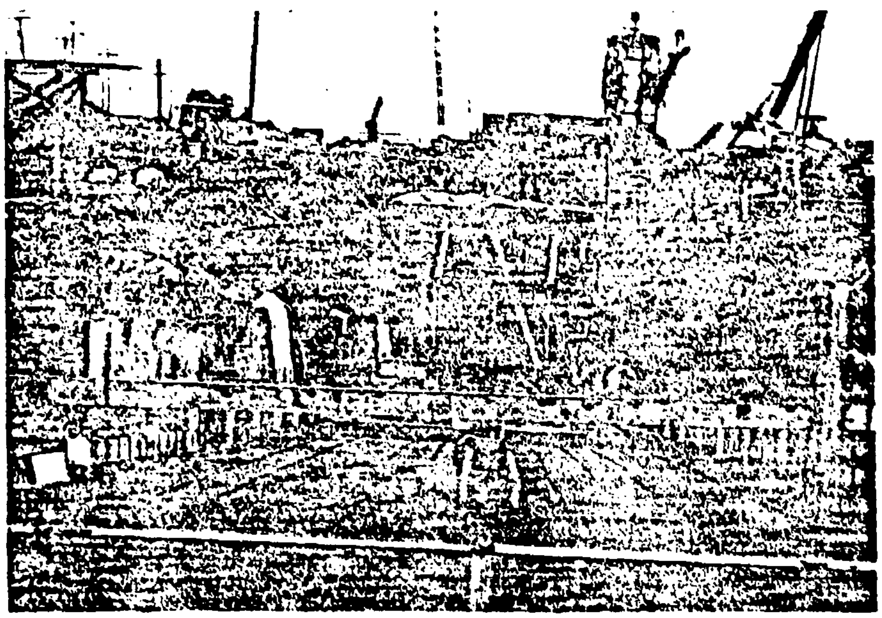
During 1977, a long term contract was signed by Republic with Pickands Mather & Co., a subsidiary of Moore McCormack Resources Inc., for transportation of up to 7,000,000 gross tons of iron ore pellets annually on the Great Lakes over a 25-year period commencing with the 1980 season. The contract provides that The Interlake Steamship Co., which is managed by Pickands Mather, will construct a 1000-ft. self-unloading ship of 60,500-ton capacity for the Republic trade.

In addition, the str. *Elton Hoyt 2nd* will be converted to a 22,400-ton capacity self-unloader to serve the Chicago plant. The 1000-ft. self-unloader, known as hull 909, is being built by The American Ship Building Co. for service beginning in 1981. Presently the bow section and a 480-ft. section of the midbody are being built at the AmShip yard in Toledo.

Originally, Republic selected Cleveland for the terminal site to effect the transfer of its iron ore pellets by shuttle vessels to its Cuyahoga River docks that only can be serviced by small vessels because of the limited draft and navigational constraints of the river. Iron ore for Republic's plants in the Mahoning Valley district then would have originated from Republic's Cleveland docks.

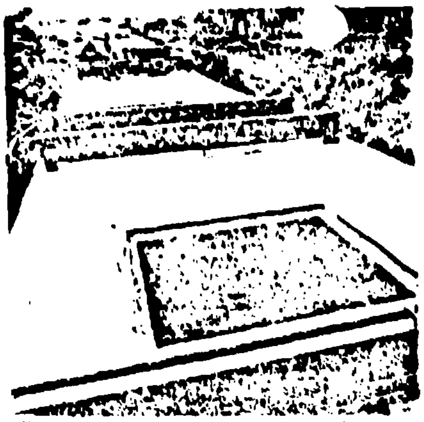
In this Cleveland plan, however, delays were foreseen because of technical difficulties relating to poor soils conditions and potential delays in getting Congressional approvals of appropriations for harbor improvements that included deepening of the channel and widening of the east entrance approach, all required for the port of Cleveland to accommodate the dimensions of the 1000-ft. class ship. Estimates indicated that these conditions would have delayed completion of the terminal beyond mid-1981 at the earliest.

At Lorain, the present harbor already can accommodate 1000-ft. vessels without additional alterations, and the site permits a more conventional terminal to be designed and constructed within a much shorter period to meet the timetable of Republic's new transportation system. In addition, Lorain provides better railroad connections to interior steel mills than Cleveland and a shorter running distance for the 1000-ft. self-unloaders coming from upper lake



Scene at the Lorain pellet terminal project looking north toward the construction activity. In the foreground is the site at which the underground conveyor belt used to transfer iron ore pellets will exit from the covered reclaim tunnel beneath pile D.

Exhibit F-7



View showing hopper top of a reclaim tunnel at the Lorain pellet terminal project. The iron ore pellets will flow through hydraulically-controlled gates onto an underground 60-in. conveyor belt for reclaiming from various piles.

ports. The Lorain facility ranks as the first transshipment terminal designed for ships built to maximum Great Lakes dimensions, with flexibility for transfer either to railroad cars or smaller ships.

In Lorain, the new terminal will have a capacity well beyond Republic's requirements to transship annually between 6,000,000 and 6,500,000 gross tons of iron ore pellets. The facility, by design, incorporates provision for future expansion and modification to handle pellets for other customers. As a result, the terminal could become the leading iron ore receiving facility on Lake Erie exceeding the quantities handled at existing major docks in Ashtabula, Cleveland, Conneaut and Toledo.

FORMER PROPERTY OF CHESSIE SYSTEM

During Dec. 1978, the terminal property, situated just inside the Lorain harbor and a short distance up the Black River, was acquired by Republic from the Chessie System. This area, covering some 25 acres north of the Erie Ave. bridge, is supplemented by the Grove property purchased previously. In addition, 43 acres are held by the company farther up the Black River for a total of 99 acres, which are sufficient for future expansion of the terminal.

For many years, the property was operated as an iron ore receiving and coal shipping dock by Toledo, Lorain & Fairport Co., a subsidiary of Baltimore & Ohio R.R., which is part of the Chessie System. As much as 2,000,000 gross tons of ore and about the same tonnage coal were handled on an annual basis. Three Brown Hoist electric unloading machines were used to discharge ore from vessels to a storage pit, which was 750 ft. long by 100 ft. wide. Eight tracks capable of handling 35 cars each were available for loaded coal cars, with four tracks for empty cars. With one of the faster car dumpers on the Great Lakes, the coal was emptied from the cars into vessels.

The feasibility study for the Lorain pellet terminal was conducted for Republic by Orba Corp., a subsidiary of Amca International Corp., which also performed the facility design work at its headquarters in Fairfield, N. J. In March 1979, Orba was given responsibility to serve as project manager and to handle all electrical, mechanical and structural installations. The principal subcontractor is Johnson Bros. Corp., Litchfield, Minn., with Indeco, an affiliated firm, handling the civil work. On March 26, 1979, Johnson Bros. moved onto the site, and on July 2, 1979, ground was broken. In Oct. 1979, and again in Feb. 1980, construction activity will be at a peak with about 200 personnel engaged in the project in the field.

In addition to excavation, the utility phase is under way with the required deeper relocation of the existing water, telephone and sewer systems, to accommodate construction of the reclaim tunnel. Construction is progressing on the 1400-ft. reclaim structure including the tunnel and conveyor system that will transport pellets to railroad or vessel loadout for completion by Dec. 21, 1979. In September, the dock construction phase was commenced with initial completion expected in March 1980.

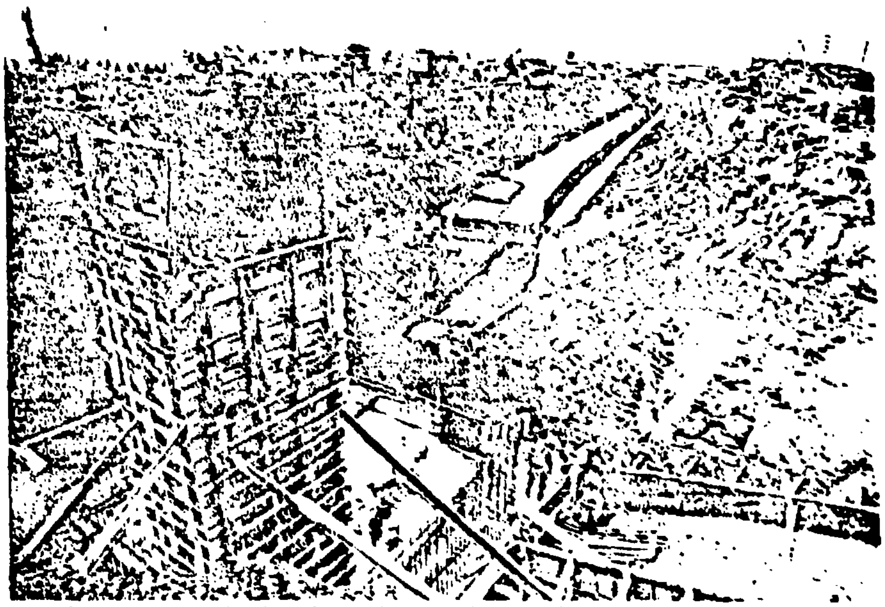
PELLET DELIVERY IN SELF-UNLOADERS

At the Lorain pellet terminal, the slip has a depth of 27 ft. and is 1100 ft. long, with a width of 150 ft. at the inner end and 420 ft. at the outer end. The iron ore pellets will be discharged directly from the self-unloaders to one of four piles segregated with moveable partitions initially for three grades consisting of Reserve, Hibbing and Eveleth pellets. The piles provide a total capacity for 530,000 gross tons comprising 300,000 tons live and 230,000 tons dead storage.

The piles designated A and B will be 70 ft. high each and provide a capacity for 240,000 and 130,000 tons, respectively. Pile C will have a height of 40 ft. for a capacity of 110,000 tons, and pile D will be 35 ft. high with a capacity of 50,000 tons. In addition to Republic's ore, space will be available for piles of pellets for other customers.

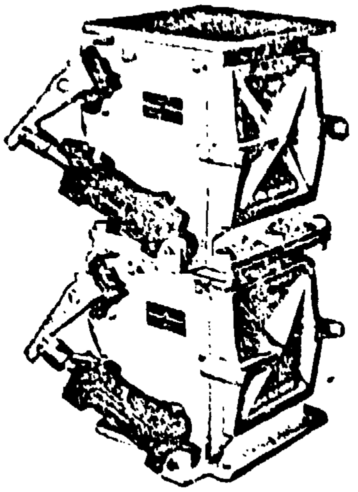
Beneath the pile, the pellets will be withdrawn by gravity through

(*Continued on page 14*)



Looking south at the Lorain pellet terminal project showing construction of the pellet transfer station for pile A, with craftsmen working on the access entry to the tunnel. In the background is the concrete base for the underground conveyor tunnel that will carry iron ore pellets reclaimed from pile B.

PLATTCO
DUST VALVES



PLATTCO MEANS:

Dependable Operation
Simple Maintenance*

Plattco Dust Valves (sometimes called tipping or flap valves) can be operated by air, electricity, or gravity.

*The patented servicing features allow cleaning or parts replacement without shut down.

Temperature to 870° C (1600° F)
Neg. pressure to 24" mercury
Pos. pressure to 20" mercury

Plattsburgh Foundry also produces custom castings in NiHard, High Chrome, and other alloys for the mining industry.

Plattsburgh Foundry Inc.

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Republic Steel Co.'s Lorain Pellet Terminal

(*Continued from page 13*)

36 hydraulically-operated gates by remote control and situated on 30-ft. centers at the rate of 5000 gross tons per hour onto a 60-in. belt for conveying to an underground transfer station. At this point, the pellets will be fed onto an inclined 60-in. belt for conveying to surface where they will be directed at a second transfer station either to railroad loadout or the shiploading berth. The underground transfer point will be equipped with a service entrance, and the entire reclaiming system will be served by an access tunnel.

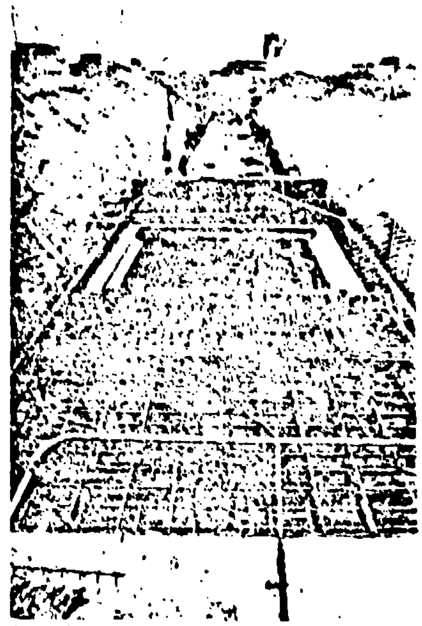
At the railroad loading station, pellets will be received on a 60-in. belt and will go to a 600-ton surge bin, then into one of two 50-ton weigh bins, from which they will be fed into 100-ton capacity hopper cars at the rate of 2500 gross tons per hour. The loaded cars will be moved to the dock side rail tracks having a capacity for trainloads of 105 cars carrying a total of 10,000 tons of pellets.

From the terminal, the trains will move 15 miles south to the main line of the Chessie System for the eight to nine-hour haul to the Mahoning Valley district in eastern Ohio for delivery to Republic's steel works in Warren and Youngstown. On an annual basis, about 3,000,000 gross tons of pellets will be transported by railroad to these plants in the Mahoning Valley.

SMALL SHIPS TO MOVE PELLETS UPRIVER

From the rail loading station transfer tower, the pellets will be conveyed on a 60-in. belt to the shiploading berth equipped with a luffing boom for feeding into the holds of vessels at the rate of 5000 gross tons per hour. Although carriers having beams up to 105 ft. can be loaded at the Lorain terminal, self-unloaders having dimensions of 638 ft. long overall with a 68-ft. beam will be used normally for moving pellets to Republic's Cleveland steel works up the Cuyahoga River, which has a 23-ft. project depth.

About two hours are required for vessels to cover the 27 miles from the mouth of the Black River in Lorain to the mouth of the Cuyahoga River in Cleveland, with another 4 to 4½ miles to the Re-



Looking north at the Lorain pellet terminal project showing the top of the reclaim tunnel at which iron ore pellets will be transferred to underground by conveyor belt. The reinforcing bars are being set in preparation for pouring of concrete.

public's lower and upper docks. Of the total 3,700,000 gross tons of pellets destined for this plant, 60% will be unloaded at the upper dock on the east side of the river and the remaining 40% will be discharged at the lower dock on the west side. Normally, the pellet cargoes received at the upper and lower docks will average between 15,000 and 18,500 gross tons.

At the Lorain pellet terminal, the environmental controls incorporate a spray system at the unloading berth as well as at the railroad and shiploading points, dust collection equipment including covered conveyors and a settling pond for retention of water runoff.

Patrick A. Manley is directly in charge of the project as manager of lake transportation planning for Republic, with headquarters in Cleveland. At the site, Joseph F. Jenkins, representative of the Chessie System, coordinates the liaison during the facility development. Joseph Pirozzi is project manager for Orba, with offices in Fairfield, N. J., and E. D. Cohen is construction manager for Johnson Bros. at the project site.